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MATHEMATICAL CONCEPT DEVELOPMENT FOR NATIVE INDIAN STUDENTS

M. Stanley & L. Falconer

REPORTS

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MATHEMATICAL CONCEPT DEVELOPMENT

FOR NATIVE INDIAN STUDENTS

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Mathematical Concept Development for Native Indian Students

This math programme was originally designed to fill in 'conceptual gaps' and prepare the student for middle-school math. The need for this programme emerged during the authors' learning assistance work with Native Indian students. It was found that these students, often through prolonged absenteeism or frequent school transfers, were lacking the conceptual building blocks necessary for middle school math.

The programme was not designed to be a complete math text or to follow the curriculum of any specific grade. It was based on the deficit areas in math most frequently encountered by the authors. Often poor language acquisition was found to be a factor of poor performance in math, hence the inclusion of pre-math language.

Originally the programme was intended for small group use. The authors envisaged groups of 8 - 10 students for optimum impact. It would be possible, however, by utilizing a grouping system, to involve an entire class in this programme.

For the majority of students it should not be necessary to begin with lesson 1 and work through to completion. The teacher will be able to determine the students deficit areas in math, and select lessons from the programme as required. As a means of checking the student's need for a specific lesson the pre-test, or probe, may be used.

Whenever the teacher, or an individual student has been referred to, the pronoun 'she' has been used. This is merely for convenience and reflects no bias.

This math programme is non-competetive and emphasises the spirit of co-operation and mutual support which the authors have found prevalent among their Native Indian students. Activities involving the entire group are used frequently and whenever possible the partner system has been used. There are no 'winners' and no formal test situations. Work involving a paper and pencil approach has been kept to a minimum. Learning through creative activities and hands-on experience has been emphasised. Activities progress from the physical/experiential to a cogitative level.

Materials necessary for each lesson are listed on the face-sheet. Whenever possible the authors have utilized classroom supplies likely to be readily available in most schools. These materials designated 'general' include --- (see materials list.)

A list of vocabulary is included in each lesson. Students could keep an on-going glossary, entering new terms and definitions as required.

Materials:

The materials listed as "general" include the following:

paper - chart, newsprint, brown, construction, coloured.....

scissors

glue

magazines

string

scratch pads

crayons

felt pens

pencil crayons

stencils

masking tape

centimetre ruler

metre stick

PRE-MATH LANGUAGE

Lesson 1 Ordinals

Materials: general, match sticks, comic strips, cassette tape and recorder, picture series.

Teacher Preparation: Activity 3, cassette tape with directions utilizing the ordinals - (first, go out the door; second, go down the stairs...) Let's Check Stencil.

Vocabulary: first, second third.....tenth and abbreviations 1^{st}, 2^{nd}... series sequence.

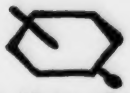
Objectives: The student will demonstrate an understanding of the concept of the ordinals by:

- verbally identifying the ordinals
- following a series of directions
- arranging pictures in appropriate order
- indicating the ordinals in a series
- matching words and symbols
- experiencing the ordinals through specific physical activities

Probe: The teacher draws several circles, in a row, on the chalkboard. The students are told at which end to begin and then asked, in turn, to put eyes on the first, ears on the fourth, hair on the second. It is important to note that this is done in a random order.

Activities: All activities are from first to tenth.

1. The teacher begins by having individual students walk across the room. The teacher asks, "Who was first?" "Who was second?" "Who was third?" etc. Then, a student directs a similar activity (such as standing up) and poses the same questions.... "Who was first?" ....

2. Students make spinners  using coloured construction paper and match sticks. Then they play guessing games regarding which spinner will stop first, second, third.....

3. Treasure Hunt: Each student (or student pair) is given a series of directions on a cassette tape: -first, go to the door, -second, go down the stairs, etc. These directions will eventually lead to some sort of "treasure".

4. Students work in pairs. They cut out comic strips then put the individual pictures in proper sequence while verbally identifying the first, second, third... The students may check the proper order by looking on the back of the comics - they will have numbered each frame before actually cutting the comic strip. Student pairs then trade comic strips and repeat the process.

5. Given a series of pictures illustrating a familiar functional activity (making a sandwich, getting ready for school etc.), the students individually or in a group decide upon the proper sequence. If the teacher is unable to find such pictures, the students can draw and paint their own.

6. The teacher writes on the blackboard:

first	1^{st}
second	2^{nd}
third	3^{rd}

There is a short discussion regarding the abbreviations. Students then make one or more flash card sets. Each set contains "first, second..." and "1^{st}, 2^{nd}...". The students play "SNAP" using these cards. Time is then given for students to develop their own games.

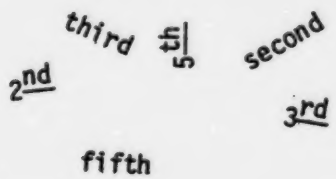
Let's Check: Each student is given a prepared stencil handout of 15 fish swimming in a row. They follow verbal directions to "X" the third fish, colour the tenth fish red, circle the second fish..... The students are then asked to label the fish from first to tenth, using the abbreviations.

Variations and Additional Activities:

1. Several items in many series are on a stencil (ex. people running, sheep jumping over a hedge etc.) The students are directed to perform various tasks such as

   - colour the first jogger green
   - circle the 9th bird

2. The teacher, or student leader, writes over the chalkboard:



The students take turns connecting the word to the appropriate abbreviation.

PRE-MATH LANGUAGE

Lesson 2

Materials: general, boxes (one for each student filled with odds and ends such as pencils, chalk, tape, string, and paperclips.

Teacher Preparation:

Vocabulary: set, sub-set

Objectives: The students will demonstrate an understanding of the concept of sets and sub-sets by:

- performing a series of physical activities
- arranging objects into sets, sub-sets using; a) teacher identified critera b) student selected criteria
- drawing and labeling sets and subsets as directed by the teacher
- drawing the appropriate set on pre-labeled paper.

Probe: Each student is given a box of miscellaneous things. The teacher asks each student to make two sets from her box. The students then explain and discuss the criteria they used to make the sets. A general discussion may ensue regarding the different criteria studetns used to make sets.

Activities:

1. The teacher has the students form sets by asking:
   - all the people in the room to stand
   - all the boys to stand
   - all the girls to stand
   - all the people wearing jeans to stand
   - etc.

The concept of belonging to a set within a set (sub-set) is discussed. For example, "Were you in the set of people and also in the set of boys?" "Were all of the boys in the set of people?".... Further examples are given and illustrated by having the students repeat specific activities such as standing.

2. A student cuts out 2 large circles and labels them (in pencil - set of red things, set of blue things). The students look around the room and put appropriate articles in the two circles. When this activity is completed, the circles are searched for possible sub-sets. For example all the pencils that are red form a sub-set.

3. The above activity may be repeated using sets of rough/smooth, hard/soft. Sub-sets are also created.

4. Using magazines, students search for pictures to make sets. These pictures are cut out and made into various collages with the appropriate titles - such as "The Food I Like to Eat" "The Set of Clothes I'd Like to Wear".

5. Each student is given a piece of paper with a label on it. For example one label may be "The set of things needed for a canoe race". The students then either draw or list the required set. It is most helpful if the teacher asks each student to list/draw a set that holds some personal interest for the student.

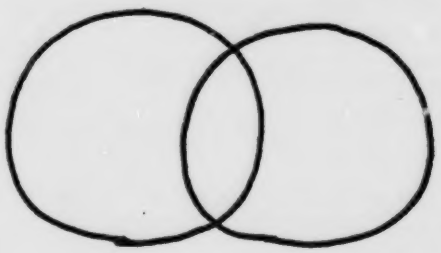
Let's Check: The students go to the chalkboard and write their own names. All the students are then asked to make a set of the names of the students who:

- are wearing runners
- are wearing jeans
- have hair that hangs below their shoulders
- etc.

The students are then asked to make sub-sets by listing for example, the long-haired students who are also wearing runners.

Variations and Additional Activities:

1. The students can place various articles inside string circles used to define sets. This way, the boundaries can be altered to create sub-sets.



2. Foods may be classified into sets by "sweet, sour, bitter, salt, spice..."

3. Large pieces of red and blue paper are put on the wall. The teacher holds up various pictures and the students hold up the appropriate coloured paper to predict where the teacher will staple the picture.

4. Using the overhead projector, the students could sort objects according to shape.

PRE-MATH LANGUAGE

Lesson 3

Materials: Overhead projector, blindfolds, 1 large box of odds and ends - (eraser, pencils, pens, paperclips...)

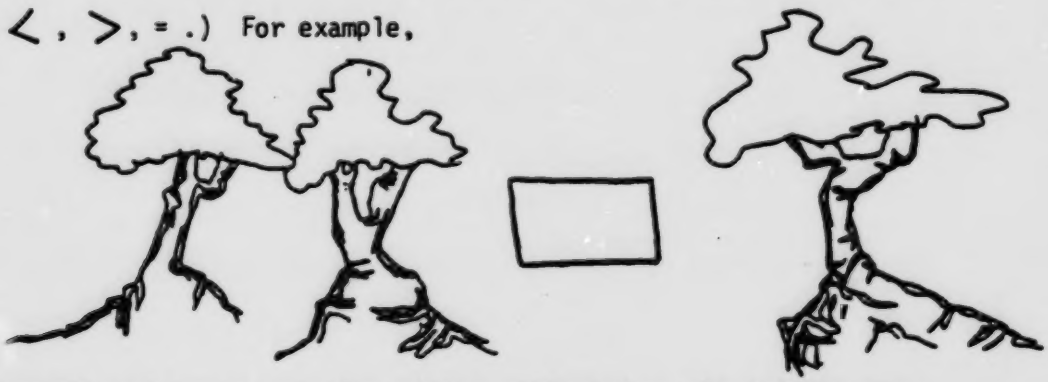
Teacher Preperation: Activity 7, Stencil.

Vocabulary: Greater than, less than, equal to and the symbols $>$, $<$, $=$. statement, symbol, illustration.

Objectives: The students will demonstrate an understanding of the concept of greater than, less than, and equal to by:

- manipulating objects to show $>$, $<$, $=$.
- placing the appropriate symbols $>$, $<$, $=$ between groups of objects
- appropriately placing articles on either side of the symbols $>$, $<$, $=$.
- using tactile sense to determine $>$, $<$, $=$.

Probe: On the overhead projector the teacher draws two groups of "something" and on personal scratch pads, the students put the appropriate sign ($<$, $>$, $=$.) For example,



These scratch pad papers are then either collected or the teacher may circulate and view the answers.

Activities:

1. The boys go to one side of the room and the girls go to the other. Are the number of boys greater than the number of girls? This type of activity is repeated using various itmes such as desks and chairs, rulers and pencils etc. Each activity, however, should involve movement of items.

2. The students are asked to go outside and bring either a twig or a stone back to the classroom. Then, in class, the group compares the number of twigs to the number of stones. The twigs and stones should be manipulated so that greater than, less than and equal to, can be used.

3. Using a large box of odds and ends, the students, as a group, make a number of verbal comparisons regarding the number of pens to the number of erasers, the number of paperclips to the number of elastic bands...etc.

4. The teacher explains the meaning of the symbols $>$, $<$, $=$, using the examples in Activity 1. Students each make a sign for each symbol and decorate it. Each sign could be labeled appropriately - greater than, less than, equal to.

5. Using the materials gathered in this lesson (twigs, stone, items from the big box of odds and ends....) students may make piles and place their signs appropriately between them.

6. The students form pairs. One student makes piles of items, the other student is blindfolded and must tell her partner which sign to place between the two piles. The blindfolded student must touch the piles in order to do this. The roles are then reversed.

ASSIGNMENT SHEET Name:_____

Using the signs < , > , = , illustrate each statement.

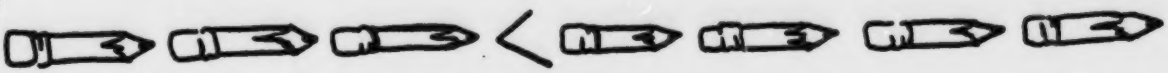
A) 5 buttons are greater than 4 buttons. _____

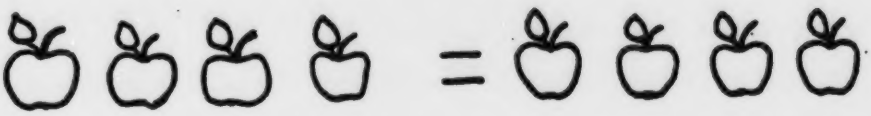
B) 7 cookies are less than 9 cookies. _____

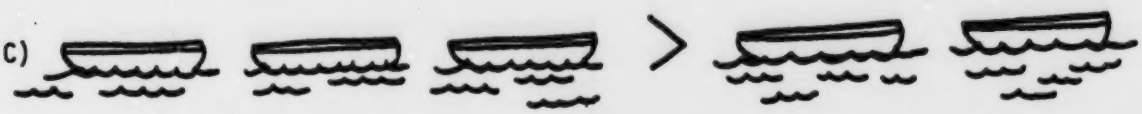
C) 6 birds are equal to 6 birds. _____

etc.

Write a statement that describes each illustration:

A) 

B) 

C) 

etc.

7. The Assignment Sheet (as above is done). The teacher could go over the sheet in order for all students to focus on the required task. Student questions may be asked and answered at any time.

Let's Check: In pairs, students come up to the chalkboard. One student writes 2 numbers, the other student writes the appropriate symbol. The students roles are then reversed. This activity continues until the teacher has a firm idea of each student's grasp of the concept.

Variations and Further Activities:

1. The students write their first and last names, then compare.

1st name	E	L	A	I	N	E
2nd name	J	I	M	M	Y	

Is the number of letters in the first name greater than the number of letters in the last name?

PRE-MATH LANGUAGE

Lesson 4 Add - Sum of and Subtract - Difference

Materials: large box of odds and ends, blindfold, large scenic picture, overhead projector

Teacher Preparation:

Vocabulary: add, sum, subtract, difference, equation, digit, total

Objectives: The students will demonstrate an understanding of concept of addition by:

- totaling the number of sounds heard
- answering questions regarding the sum
- completing and solving equations
- using the symbol + correctly

The student will demonstrate an understanding of the concept of subtraction by:

- using tactile sense to determine the addition or subtraction of items
- completing and solving equations
- using the symbol - correctly

Probe: The students write the answers to verbally asked questions on their scratch pad and hold up the paper so the teacher can see. The questions are: - what is the difference between the number of boys and the number of girls in this room?

- what is the sum of tables and chairs in this room?
- etc.

From the large box of odds and ends, students are asked to add the number of pencils to the number of pens. What is the sum? Various questions

may be asked. Each answer is recorded on the student's scratch pad. Using the same box of odds and ends, subtraction questions could be asked. On the chalkboard, students place the symbols + - correctly.

5 ☐ 3 = 2 3 ☐ 2 = 5

All or part of the Probe activities may be performed.

Activities:

1. Two students are instructed to stand at the front. The teacher asks, "Let's add 3 more. Now, what is the sum of students at the front? How many in total?" Let's subtract 3 students, how many are left? What is the difference between 5 and 3?"

This activity is repeated several times to emphasize the vocabulary and the fact that subtraction is the inverse of addition.

The symbols - , + are then used, on the chalkboard as alternatives for the words add and subtract.

2. As in the first activity, students are used to concretely demonstrate addition and subtraction. This time, however, the the teacher also writes on the chalkboard, the equation for what is taking place. At this point the teacher could introduce the word "equation" - drawing attention to the = sign.

3. Using the items in the large box of odds and ends, students write equations on their scratch pads that record the concrete activity. For example, 7 paperclips may be set out. Then, the teacher may take 3 away. The students would write 7 - 3 = 4.

Eventually, students take turns removing/adding objects as others write the corresponding equation. The strategy is then reversed as a student writes an equation on the chalkboard and another demonstrates with items from the large box of odds and ends.

4. Student pairs use items from the large box of odds and ends. One student is blindfolded, the other arranges articles and lets the blindfolded student "feel" the number of articles. Then the student either adds or subtracts items. The blindfolded student "feels" again, states what operation was performed and then, both students write an equation on the chalkboard or scratch paper that describes the operation.

5. A concealed student claps out a sequence example, 3 claps - pause - 6 claps. The other students listen and respond either with the total number of claps or recording the total number on scratch paper and holding up the answer. This activity may then be reversed for subtraction.

6. The group discusses a large scenic picture. Possible equations are looked for and recorded on the chalkboard. For example the difference between the number of trees and the number of bushes may be 7 - 5 = 2. After some group work, students may look for and create equations on their own or with a partner.

Let's Check: The overhead projector or chalkboard is used.

a) Students are asked to give the sum of the following numbers:

7,9 6,3 10,7 4,8

b) Students are asked to give the difference of the following numbers:

5,3 8,9 9,4 7,10

c) Students are asked to make the following equations true

5 ☐ 3 = 8 2 ☐ 9 = 11 9 ☐ 4 = 5 7 ☐ 5 = 2

PRE-MATH LANGUAGE

Lesson 5 Qualities

Materials: masking tape - different widths (different colours if possible, a series of pictures or drawings that illustrate narrow to wide (for example a series of pictures of trees with narrow to wide trunks), two bins or containers of some kind, a piece of pumice and a rock, coffee tins filled with varying amounts of sand, balance scale, several pictures of animals or objects, general, cassette tape and recorder.

Teacher Preparation: Let's check, stencil.

Vocabulary: wide, wider, widest
narrow, narrower, narrowest
short, shorter, shortest
long, longer, longest
light, lighter, lightest
heavy, heavier, heaviest

Objectives: student will demonstrate an understanding of the specific concepts (wide/narrow, long/short, heavy,light) by:

- using their bodies to illustrate these qualities.
- classifying objects and pictures appropriately.
- using these qualities to compare two objects.
- arranging objects and pictures into appropriate categories.
- using auditory discrimination to determine long/short.
- using tactile discrimination to determine heavy/light.
- using string to represent and compare length.
- incorporating these qualities into a group art activity.

Probe: Wide and Narrow. The students are asked to find, in the room, something narrow and something wide. They then put the wide thing on their desk and hold the narrow thing in their hands. The teacher may ask for an explanation as to why they made the choice they did etc.

Long and Short.

Heavy and Light.

Variations of Wide and Narrow can easily be used.

Activities: Wide/Narrow

1. The students illustrate the concept of wide and narrow by:
   - making their bodies as wide as they can, as narrow as they can
   - this may be repeated with arms, mouths, eyes.

2. Each student is given two different thicknesses of tape (one wide, one narrow). It is preferable that the tape be of different colours but if that is inconvenient, plain masking tape may be used. Each student decides which tape is wide and which tape is narrow. Then the students stick their tape on a chart labelled wide and narrow, forming an abstract design. If plain masking tape is used, the tape may then be decorated using felt pens or crayons.

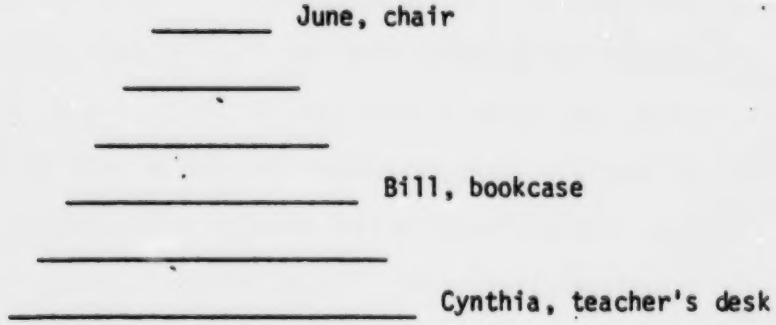
3. Each student is directed to two different areas. They roll across the designated space to "feel" which is wide and which is narrow. This is followed by a group discussion and trading spaces.

4. The teacher arranges a series of pictures (tree trunks for example) from narrow to wide. The comparison vocabulary is then used (narrow, narrower, narrowest, wide, wider, widest.....). The students are then allowed to explore this concept and vocabulary by making statements like:
   - The tree at the end is the widest.
   - This tree is narrower than that tree.

At first, this may be awkard but with the students collected around the pictures eries, it becomes quite easy to encourage a "chatty" conversation using these words. It is recommended that these words be written on the chalkboard.

5. Each student is assigned a piece of furniture to measure with string. They cut the string to correspond to the width of the piece of furniture. They bring the string back and specify to the group what they measured, "The chair was (holding up the string) this wide". A group discussion then ensues - Which pieces of furniture are wider than John's desk?

   In order to answer such questions, the students may compare string lengths. After the discussion, all students arrange the string bits from wide to narrow and tape them to a large piece of paper. By each string length the student should write her name and what she measured. For example;



6. As a group, the students make a mural of, for example, a lake and surrounding countryside. The students discuss and cut wide/narrow canoes, trees, paddles, etc. and glue onto mural. These same items could then be labelled wide or narrow with a felt pen. Before the students labelled these items, they would give a reason why they decided as they did.

Long/Short

7. The students join hands, extend arms and form a long line. Then the students bunch up together and form the shortest line possible. If there are many students, 2 lines could be formed and comparisons could be made.

8. The students arrange desks to form a long line, then beside that, arrange desks to form a short line. Questions such as, "How can an equal number of desks be made to form a long line and a short line if the desks have to be touching each other?" Should be discussed before the activity is in progress.

9. Two bins (labelled long and short) are placed in front of the group. The teacher holds up 2 objects and the students suggest which bin each object goes in..... students then take over the teacher's role.

10. Each student is given string and scissors. They are instructed to measure the distance from the floor to seat of various chairs in the room. The students then arrange the string on a chart from shortest to longest. Various comparisons may be made as the students are labelling the chart. Some discussion should be centered around the labelling alternative. For example:

11. The students compare arm lengths by standing in a line. They arrange themselves, in the line, from shortest arm to longest arm. Someone should record the order in the line.

12. In pairs the students trace around their arms, decorate the drawing and then cut it out. The "arms" are then hung in order of shortest to longest. This order is then compared to the recorded order in Activity 5. If the order is altered, the group should discuss "Why"?

13. With their eyes closed, the students listen to a series of long/short sounds on a cassette tape (or the teacher could make a series of long/short noises). The students then indicate if the first sound was the longest - thumbs up means yes, thumbs down means no.

14. A list of words is written on the chalkboard. For example, "bus, pencil, banana, etc." The words are then read aloud in order to make sure all students are aware of each word's meaning. The students are then requested to "draw those things that are longer than your shoe".

Heavy/Light

15. The students take turns holding a piece of pumice and a rock. When all have had a turn, they are asked to pint to the one that feels lighter than the other. This activity may be repeated several times using different materials.

16. The itmes used in Activity 1 should be placed on a simple balance scale. The students may then discuss how the scale shows that one item is heavier than the other. Several comparisons should be made.

17. Several coffee tins are filled with different amounts of sand. Student pairs, or individuals, arrange these tins in order of lightest to heaviest. The order can then be checked with the simple balance scale.

18. The students are in pairs. One student selects a heavy coffee tin and a light coffee tin. The other student closes her eyes and holds out her hands. The first student puts a tin in each hand and the other student acts as a balance (for example, hand with heavy tin goes down and the hand with the light tin goes up). Roles are then reversed. If there is any question as to which is the heavy or light tin, the balance scale can be used.

19. Individual students may classify a series of pictures (animals and objects) into "things that are too heavy for me to lift" and, "things that are light enough for me to lift."

Combined Activity: Students and teacher may go for a walk looking for examples of long/short, narrow/wide, heavy/light. They, including the teacher, may draw examples of such qualities upon returning to the classroom. While drawing, group discussion should be encouraged.

Let's Check: First, the Let's Check stencil should be done as below. The teacher should go over the entire paper in order for all students to focus on the required task. All student questions, asked at any time, should be answered. Second, the students participate in "Let's Check Light and Heavy". Each student makes a light and a heavy label. All students place their two labels on different items in the room. Each student takes a turn showing where they put the labels. If there seems to be any confusion as to why a student labelled something light or heavy, questions may be asked by the teacher or other students.

Let's Check: On a stencil.

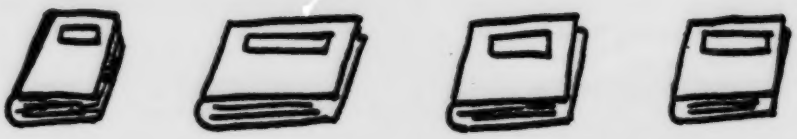
Name_____

a) Wide and Narrow.

- Draw a wide box

Draw a narrow box

- Put an "X" on the narrowest book and circle the widest



b) Long and Short.

- Colour the shortest man red and the longest man green

- Put a line under the things that are shorter than your thumb, paperclip, cat, ruler, safety pin, bug,.....

GRAPHING

Lesson 1: Bar Graphs and Pictographs

Materials: general, graph paper or stenciled graphs

Teacher Preparation:

Probe.	Stencil
Activity 1.	Large Chart
Activity 2.	Stencil or graph paper
Activity 3.	Large chart
Activity 4.	Large chart

Vocabulary: graph, bar graph, pictograph

Objectives: The students will demonstrate an understanding of the use and interpretation of bar graphs by:

- sorting and counting a specific number of objects to make a bar graph.
- explaining the information shown on a bar graph and using the information to complete an assignment sheet.
- by counting vehicles at specified intervals and using this information to compile a bar graph.

The student will demonstrate an understanding of the use and interpretation of pictographs by:

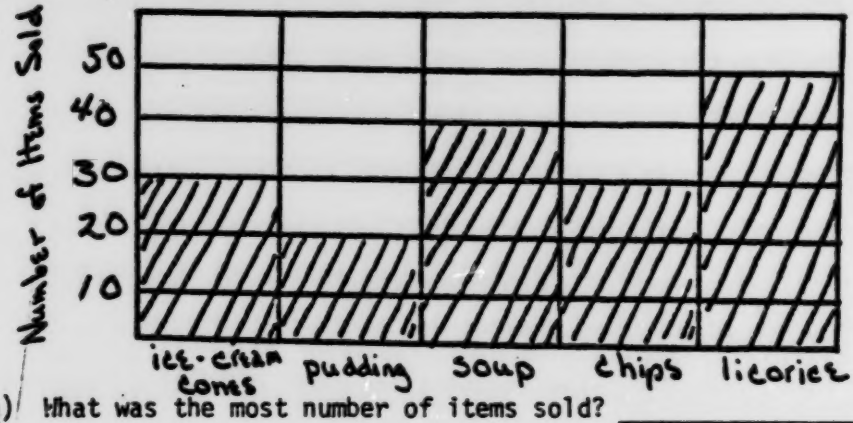
- discussing information presented in a pictograph.
- using student collected information to prepare and make pictographs.

Probe: Allow the students time to complete the following stencil.

Probe

Name: _____

A) Items sold at Mount Newton's Canteen



a) What was the most number of items sold? _____

b) What was the least number of items sold? _____

c) How many more licorice sold that Pudding? _____

d) What was the total number of items sold? _____

e) Circle the correct answer.

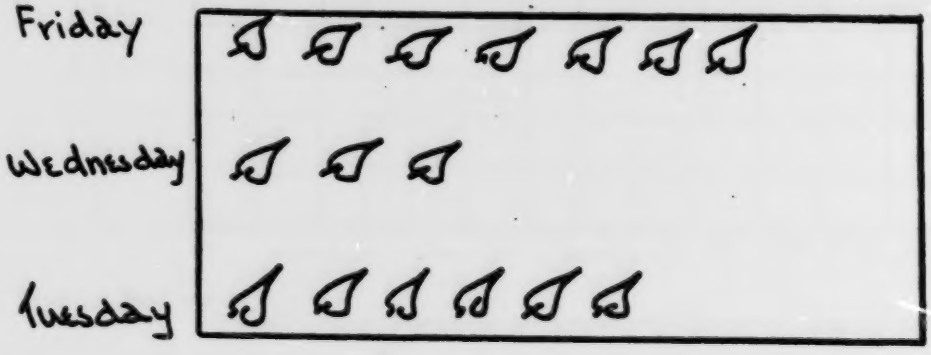
This type of graph is called a

Line Graph

Bar Graph

Pictograph

B) The Number of Leaves That Fell on Three Windy Days



= 25 leaves

a) How many more leaves fell on Wednesday than Friday? _____

b) The total number of leaves that fell on Tuesday was _____

c) How many leaves fell on the three days altogether? _____

d) Circle the correct answer. This type of graph is called?

Pictograph

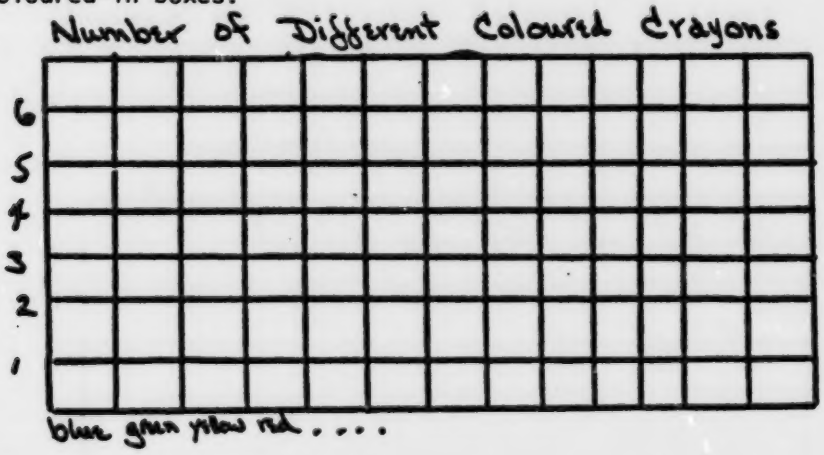
Line Graph

Bar Graph

Activities:

1. The group of students is given a large piece of paper, marked as below. They are given a box of assorted crayons and asked to sort the crayons into piles of blue, red, etc. The students are then asked to colour one block on the marked paper for each crayon in the specified colour pile.

The teacher then explains that often information is presented visually in the form of a graph. There are different kinds of graphs such as pictographs, line graphs, and bar graphs. They have just made a bar graph. Attention is then drawn to the "bars" formed by the coloured-in boxes.



a) Number of blue ☐ red ☐ green ☐ yellow ☐ ....etc.

b) There were ☐ crayons altogether

c) There were most ☐ crayons

d) There were least ☐ crayons

The group then interprets the crayon bar graph and fills in the information asked for on the bottom of the graph. Again, attention should be drawn to the "bars" created on the graph.

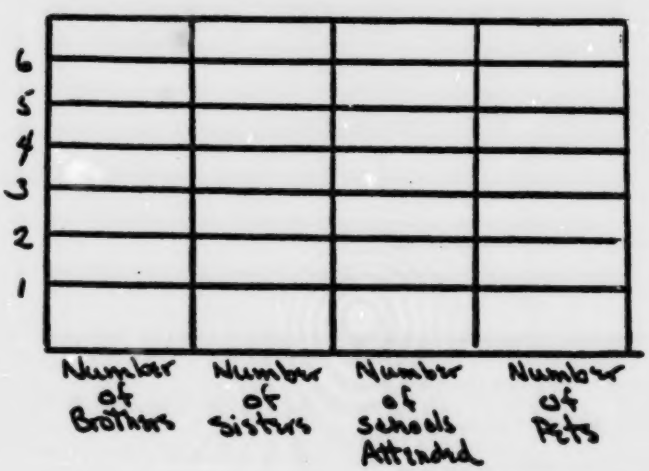
2. Students form pairs in order to collect information from each other on personal-family data. When each student has completed the information gathering (the questions could be written on the chalkboard and the information could be recorded on scratch pads), she must make a bar graph that presents her partner's information. The stencil for this assignment sheet is presented below.

   The students then check each other's graph to make sure that all information presented is correct. These graphs are then made into a wall display. It is most attractive to have student photographs accompanying the graphs.

Assignment Sheet

Name: _____

This bar graph is about _____



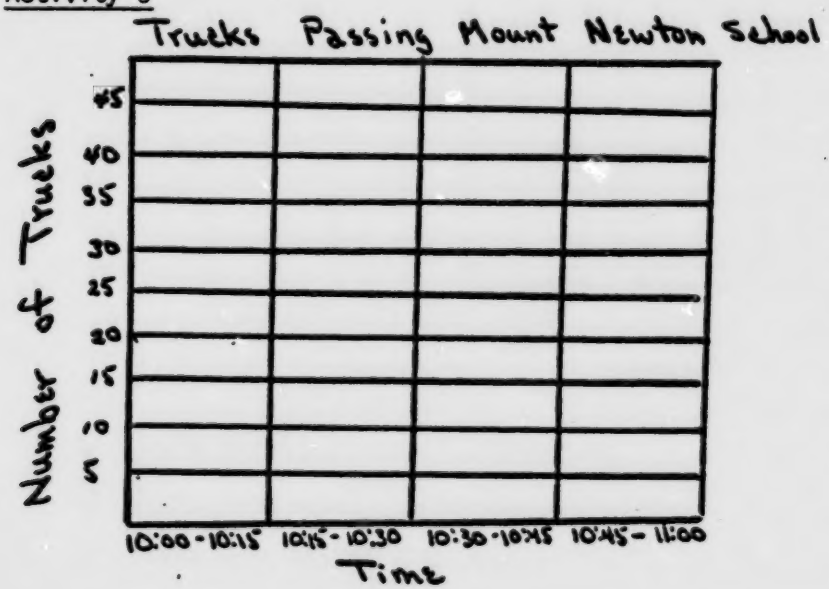
3. A short discussion centres around traffic passing by the school (amount, type, etc.). After interest is peaked, the students decide to actually count the number of trucks, for example, that pass by the school in one hour. This could be limited to the trucks passing in just one direction if the school is situated in a very busy commercial area.

After 4 pairs have recorded this information, or all students have had a turn, a bar graph is prepared - using the chart below. Each student or student pair should place their own truck-count information on the large chart. When this is completed the group, assisted by the teacher, interprets the graph - discussing such facts as:

- which time period had the most trucks pass by?
- how many trucks in the first fifteen minutes?
- how does this compare to the last fifteen minutes?
- which time period had the least number of trucks pass by?

Depending on the group of students, this exercise could be completed by each student holding up the appropriate time-period card, using scratch pads to record answers, verbally answering questions, or answering questions on a stenciled assignment sheet.

Activity 3



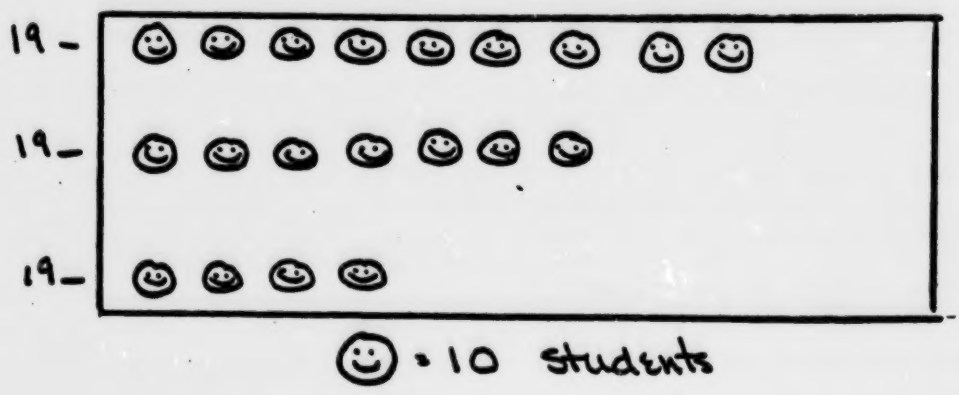
4. A) The teacher talks to the students about another type of graph - the pictograph. This graph uses pictures to visually present information. A large pictograph (see below) is shown to the students. This graph should be of some general interest to the class - such as the number of Native Indian students that have attended the school in the past 3 years.

Verbally, the students discuss and interpret the chart, finding out how many students in each of the 3 years, whether there are more or less Native Indian students this year, etc.

Activity 4

A large pictograph (chart sized for whole group use)

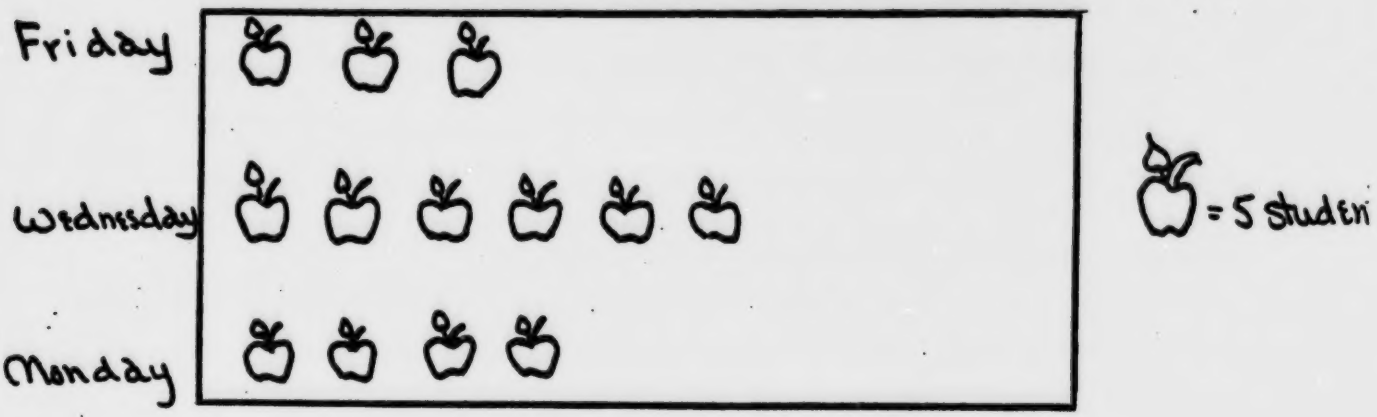
Number of Native Indian students attending our school in 19____, 19____, 19____.



B) The students, with the teacher's help, decide what information they could collect and show with a pictograph, and exactly what kind of a pictograph they would attemp to make. An example might be the number of students in a larger group (home-room class perhaps) who have apples in their lunch on 3 different days and = 5 students.

The students set about collecting the information and creating the pictograph. The teacher acts as a resource person and, if possible, allows the students to fully explore this problem solving and creative process. The final product may look something like the following:

Number of Division 7-3 students who brought apples on 3 separate days.



A Pictograph

This pictograph may be given to the appropriate home-room teacher and students or, kept in the classroom for an information chart. This decision is left to the students.

5. The students determine which school recreational event they would like to improve, for example - sock hops.

The students close their eyes for a few minutes and visualize exactly the kind of sock-hop they would really like. Questions could be asked in order to aid visualization. Is it in the gymnasium? Are there any decorations? Is there a disc-jockey? Are the students in costumes or everyday clothes? The students then open their eyes and share ideas, discuss improvements, etc.

With the teacher's help, if necessary, the students compile a questionnaire for use with the entire student body. These items may be:

1. I would like refreshments sold at sock- hops. ☐
   I don't want any food or drink sold at sock-hops. ☐
2. I would like live music. ☐
   I would rather have a disc-jockey and records. ☐
3. I would like to have a sock-hop every month. ☐
   I think that 4 times a year is enough. ☐

The students form pairs and decide, as a group, how many students each pair should question (example: 10). Each student pair then takes a questionnaire and interviews 10 students to find out their sock-hop preferences. As indicated by the suggested questions, the answers could easily be recorded with a in the appropriate place.

The students rejoin the group and total numbers recorded for each questionnaire item. While this is being done, verbal discussion is encouraged.

Before actually embarking on the pictograph, concrete plans must be made. How will we represent the students polled?

What is the title of this pictograph?

How big will we make it?

☺ = 5 students ?

☺ = 5 students ?

Using these plans, the pictograph is made and then given to the Student's Council.

Let's Check: The following is written on the chalk board.

A) Make a bar graph showing the number of sandwiches Jack ate during the week. Don't forget to give the graph a title.

Monday - 4 sandwiches
Tuesday - 3 sandwiches
Wednesday - 0 sandwiches
Thursday - 2 sandwiches
Friday - 5 sandwiches

B) Make a pictograph showing the number of people who went to see a movie.

Friday - 110 people
Saturday - 90 people
Sunday - 50 people

☺ = 10 people

The teacher reads over the directions in order to ensure that all students understand the required tasks. Questions may be asked and answered at any time. (Some students may need help dividing by 10 in Part B).

GRAPHING

Lesson 2: Co-Ordinates and Line Graphs

Materials: General, bean sprouts, containers, wet paper towels, graph paper or stenciled graph paper, stop watch or clock with second hand, felt pieces.

Teacher Preparation:

	Probe.	Stencil
	Activity 1.	Stencil
	Activity 2.	Stencil

A large piece of lightly coloured felt with a large spaced graph drawn on it. Felt cut-outs of a house, school, pet store, playground, park, boy.

Activity 5 and Let's Check: 2 lists of co-ordinates that, when connected give a simple picture.

Activity 6: A sprouted bean for each student... For each student you will need - a small container, a wet paper towel, a bean. Put the bean between the container and the paper towel. Allow the bean to sit in the container until it sprouts.

Vocabulary: co-ordinates, line graph, plot, base line, point.

Objectives: The student will demonstrate an understanding of the use of number pairs as co-ordinates by:

- following directions to locate a series of specified co-ordinates.
- using co-ordinates to describe the location of a drawn object.
- using co-ordinates to make a picture.
- using co-ordinates to give directions.

The student will demonstrate an understanding of the use and interpretation of a line graph by:

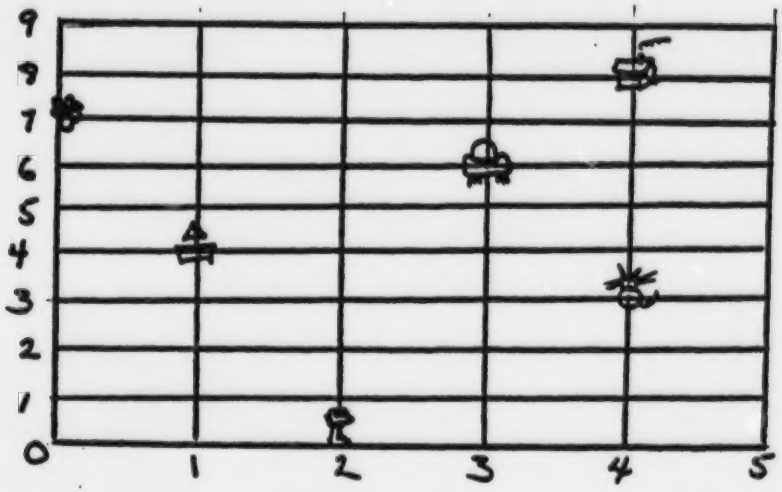
- creating a line graph based on student-collected information.

Probe: each student is given a stencil, as below.

Probe

Name: _____

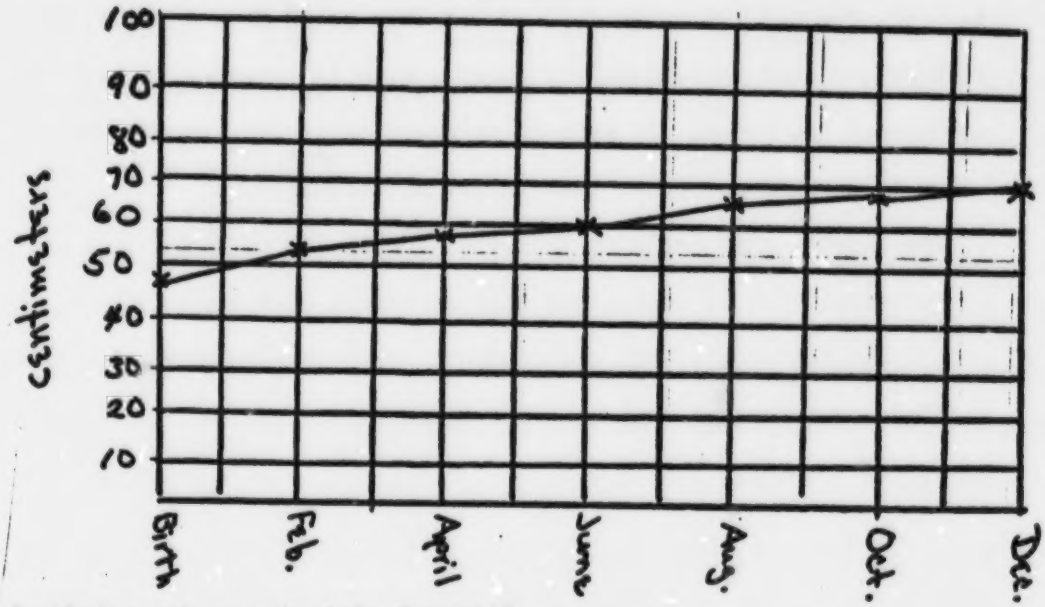
A)



Put a ✓ under True or False

	True	False
A) The co-ordinates of the ( ) house are (4,9)		
B) The co-ordinates of the ( ) cat are (3,4)		
C) The co-ordinates of the ( ) flower are (7,0)		
D) The co-ordinates of the ( ) sailboat are (1,4)		
E) The co-ordinates of the ( ) tree are (2,0)		
F) The co-ordinates of the ( ) car are (3,6)		

B) Centimetres That a Baby Grew in One Year



a) What month was the baby longest? _____

b) How many centimetres was the baby in

August? _____

June? _____

October? _____

c) How many centimetres did the baby grow during the year? _____

Activities:

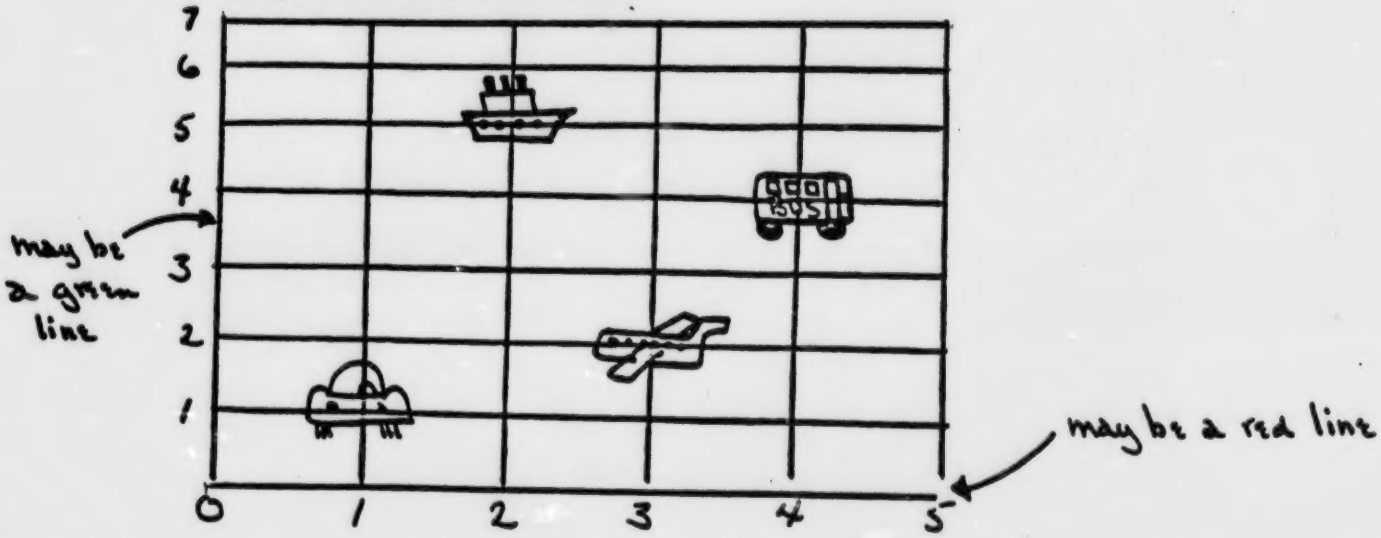
1. The students are given a piece of large spaced graph paper. They are asked to mark the horizontal baseline red, and the vertical baseline green. The word "baseline" is explained. The teacher numbers the horizontal and vertical lines of one student's paper while the others are watching. The other students mark their own paper in the same manner, while the teacher walks around and ensures that all are marking correctly.

The students are asked to put their finger on "0" and go across to "4", from "4" go up to "6", and at this point draw a small "x". Five or six such directions are given - with the teacher circulating throughout the group. At each co-ordinate point the students may be asked to draw things other than merely putting an "x".

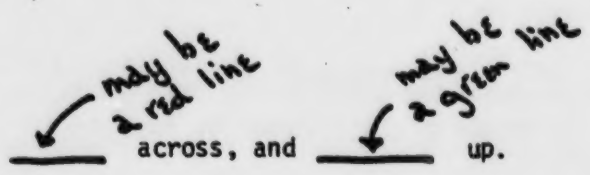
The teacher then explains that the "across and up jumps" are called co-ordinates. It is emphasized that we always move across first, then up. Using the same graph, the students may give each other co-ordinates to find. The teacher must continue to circulate so that no student goes "off track".

2. Using the graph (as below) the students review baselines and the idea that the first co-ordinate goes across, the second goes up. The red and green blanks are then filled in. Different students should come to the chart and illustrate the movement across, then up. When all blanks are filled in, students could take turns drawing more transportation items (roller skates, canoe, dog sled, hang glider.....) on the graph. Statements could then be written, complete with red and green blanks, for the group to fill in.

A large paper with the following graph marked, and questions (with red-green blanks) underneath.



Fill in the co-ordinates.



A) The car ( ) is _____ across, and _____ up.

Its co-ordinates are , .

B) The Ship ( ) is _____ across, and _____ up.

Its co-ordinates are , .

etc.

3. The large piece of lightly coloured felt (graph) is securely attached to a surface. The felt pieces representing the house, school, boy, etc., are shown to the class and stuck onto the felt graph in different positions. The students form pairs and the task is explained.

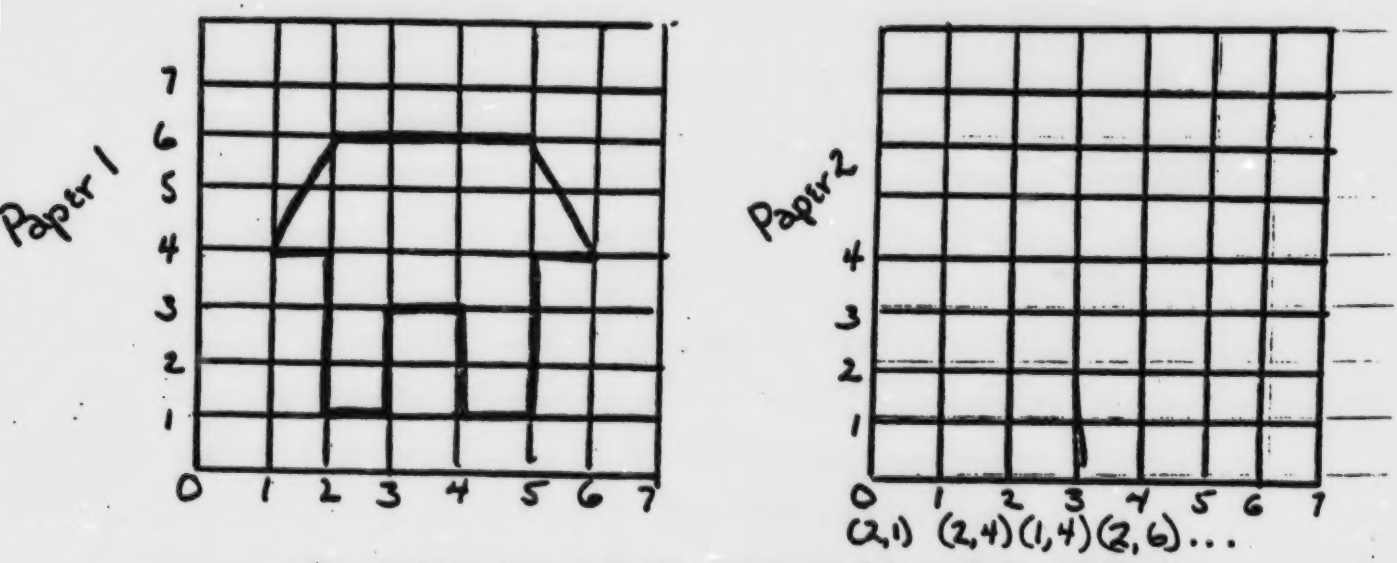
   One student is designated to move the boy. The other student plots the boy's route home from school.... she arranges the felt shapes on the board and gives appropriate co-ordinates to get the boy from school to home with any combination of the available stops. The student moving the boy must follow these co-ordinates. The students then change places. They make the story as elaborate or as simple as they like.

4. A) As a group, the students explore the possibility of using co-ordinates to make a picture on the chalkboard or a large piece of graph paper. The teacher refers to her list of co-ordinates (see Teacher Preperation) and has each student plot a co-ordinate. The students record the co-ordinates at the side of the graph (3,4) (5,7).... As each student plots a point, it is connected to the previous point. The picture develops. This exercise may be repeated many time.

   B) Students now find a partner and are each given two pieces of graph paper. Baselines are drawn. On the first piece of graph paper, students draw a simple picture and on the second piece of graph paper, they write

only the co-ordinates, in order (3,4) (5,6) (6,1), that would give the picture that they just drew.

For example:



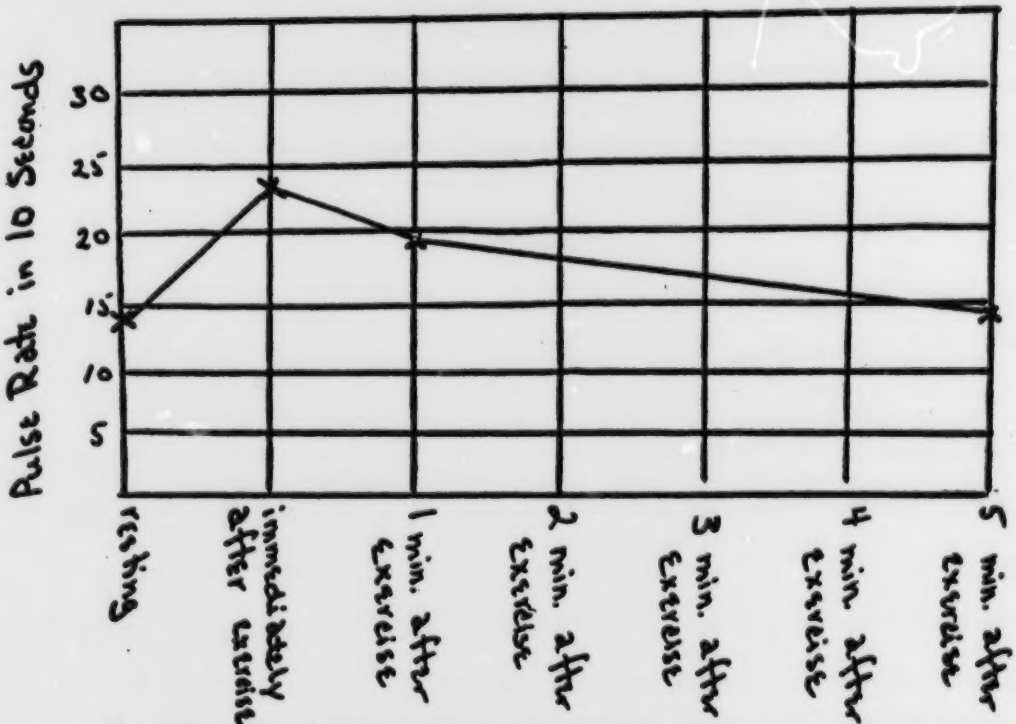
The students then exchange papers and follow their partners' co-ordinates to make a picture. When all have completed this task, the co-ordinate pictures are matched up to the original pictures as a "check".

5. B) The teacher explains that the group will make a graph showing students' pulse rates (heartbeats) before exercise, immediately after exercise, 1 minute after exercise, and five minutes after exercise. A student volunteers for the exercise and her pulse rate is taken (middle finger on side of neck) for 10 seconds only. On the chalkboard, the teacher draws a large graph and records the "resting" pulse rate. The student then runs up and down the stairs four times, runs around the school twice, or some other form of fairly intense exercise. The students'

pulse is then taken at the previously mentioned times and recorded on the chalkboard graph. These points are then connected and the graph's information is discussed. During this discussion, the teacher comments that all line graphs have a continuing line connecting the specific points and that information can be found anywhere on the line - not just at the co-ordinate points. Examples should be given - such as the pulse rate at the 2, 3, 4, minute intervals.

The chalkboard graph may look something like the following:

June's Pulse Rate Before and After Exercise



B) After the information is thoroughly discussed, all students should have the opportunity to complete a line-graph based on their own pulse rates. The students are supplied with graph paper and base lines, numbers, titles, etc. are drawn and labelled. Time is then given for all students

to exercise and measure their pulse-rates. The information is then put on the graphs. Students are encouraged to help each other and the teacher circulates, acting as an advisor and resource person.

6. All students are given a bean that has sprouted (see Teacher Preparation) and they are told that they will make a graph of the sprout's growth. First, the students label the sprout containers with their names. Second, each student is given a piece of graph paper and it also is "name-labelled." The graphs are then set up with baselines (horizontal - days, vertical - height in centimetres). The graphs are then displayed close to the sprout containers. Daily, the students measure and record, by a continuing line, the sprout's growth. Also, the students check to ensure the paper towel remains damp. The students are encouraged to look at each other's sprouts/graphs and compare rates of growth.

Let's Check:

A) Students are each given a piece of graph paper. They must set up the baselines as directed by the teacher. The teacher may offer help to those who need it, but must be aware that this need for help may indicate a need for further instruction. The students are then directed to look at the chalkboard. The teacher writes a series of co-ordinates that, if connected, form a picture. The students plot these points on their graphs and connect the points to form the picture.

B) These instructions are written on the chalkboard and graph paper is provided for each student.

5 a.m.	1^{o} celsius
7 a.m.	3^{o} celsius
9 a.m.	4^{o} celsius

11 a.m.	6^{o} celsius
1 p.m.	6^{o} celsius
3 p.m.	4^{o} celsius
5 p.m.	3^{o} celsius

The teacher reads the instructions and reminds the students about the meaning of a.m. and p.m. and also celsius degrees.

BASIC NUMERACY

Lesson 1: Number Sequence

Materials: some sort of container, papers of different textures, general

Teacher Preparation:

	Activity 3.	Large drawn snake
	Activity 4.	Follow-the-dot Pictures
	Let's Check.	Stencil

Vocabulary: sequence, digit

Objectives: The student will demonstrate an understanding of number sequence by:

- counting orally
- using tactile sense to identify number, and orally state the preceeding and following number
- writing all missing numbers in a given sequence

Probe: The teacher writes a number, from 1 to 100, on the chalkboard and asks the students to write the next or preceeding number. The teacher may vary this by writing 2 numbers, such as 53 _____ 55, or _____ 87, 88, _____, and ask the students to fill in the missing numbers. This type of probe may be done with numbers greater than 100.

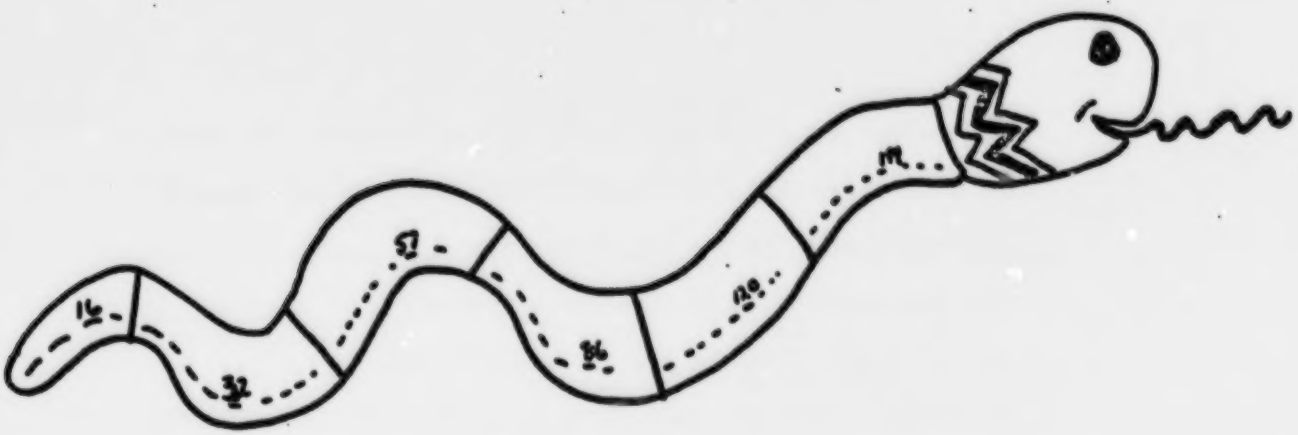
Activities:

1. As the students come into the room, they are given some small pieces of paper, four for example. They randomly pick numbers from 1 to 100 and write one on each paper. The teacher collects the papers and deposits them in a container. The teacher assigns a number range to each student. (John for example has 1 - 20, Jenny has 21 - 40, ...) The "Counting Game" then begins:

- the teacher draws a number, calls it out, discards the paper
- the student whose number range includes the "called" number, continues orally to the end of her range.
- that same student, upon successful completion of counting, draws another number from the box and calls it out.
- the process continues at a rapid pace until all of the number papers have been used and discarded.

2. Collage: The students are allowed to select materials from a wide range of textures and patterns (for example: embossed wallpaper, corrigated cardboard, material, sandpaper, shiny paper, etc.). The students then draw and cut out numbers from 0 - 9 (size is a personal choice). Then, the students form pairs:
   - one closes her eyes, the other arranges a 1 digit number
   - the first student then touches the number, states what it is, then gives the preceeding and following numbers
   - students reverse roles
   - this process is repeated using a 2 digit number (it is also possible for the students to use 3 digit numbers). The students may then glue their numbers onto a large piece of paper to make a group number collage. This may be done in a random order, with students pairing-up or putting numbers on individually.
3. Number Snake: The teacher draws a huge snake that can be divided into a section for each student. Each section has only one number filled in. The student must then fill in all the other spaces.

   Now working co-operatively, the students piece together the various sections in the appropriate order - and add a decorated head.



4. Number Follow-the-Dot Pictures: Students are given follow-the-dot pictures. They begin with the smallest number and work to the greatest. The numbers are not in consecutive order, nor in a specific sequence - merely from smallest to largest.

If artistic, the teacher can create her own pictures, if not, she may use outlines drawn in children's colouring books.

Let's Check: The students are given an assignment sheet.

Let's Check

Name: _____

Directions: Complete each number sequence.

A) 27, 28, 29, ___, ___, ___, ___, ___, ___

B) ___, ___, ___, ___, 46, 47, ___, ___, ___

C) ___, ___, ___, ___, ___, 109, 110, 111, ___, ___, ___

etc.

BASIC NUMERACY

Lesson 2: Counting by 2's, 5's, 10's

Materials: counters (4 sets - 4 same soloured counters in each set), a die, paper with 100 spaces on it (10 spaces across, 10 spaces down - such as graph paper, general.

Teacher Preparation:

Activity 4.	A board game and spinner
Activity 5.	Follow-the-dot pictures
Let's Check.	Stencil

Vocabulary: two, five, ten, twenty-five, fifty, seventy-five, hundred, even numbers.

Objectives: The student will demonstrate an ability to count by 2's, 5's, 10's to 100, - by completing, both orally and in written form, a given sequence.

- physically manipulating objects to indicate the given sequence.

Probe: The students are asked to complete 3 tasks. First, write by 2's to 100. Second, write by 5's to 100. Third, write by 10's to 100. The teacher may begin each sequence on the chalkboard.

Activities:

1. The teacher engages the group in a short discussion of 2's (eyes, legs, etc.) 5's (fingers on one hand) 10's (toes). After these clusters of numbers are discussed, examples found, and further illustrations given, the teacher asks, "How many eyes in the group?"
   "How many toes in the group?"
   "How can we tell quickly - without counting individually?"

The idea that we are able to count quickly by 2's 5's, or 10's is stressed.

2. Each student is given a paper with 100 spaces on it such as graph paper. This paper must have 10 spaces across and 10 spaces down. The students are asked to write in the numbers 1 to 100. Then, they are asked to:
   - circle in red, every second number starting with 2
   - circle in blue, every fifth number
   - circle in yellow, every tenth number

   As a group, they are asked to read off all the 2's, then 5's, then 10's. This enables the teacher to check that all have marked correctly and also builds confidence in giving oral responses. Once the students generally feel confident, they take turns reading the numbers aloud. Often, attention should be drawn to the visual patterns on the paper and other patterns such as, "counting by 2's identifies even numbers."

3. As a group, the students clap and chant - counting by 2's, 5's, 10's. This activity may be extended to all students clapping and students taking turns calling out the next number. Then, the teacher may ask a student to count to "70 by 5's". The other students may snap their fingers as the student counts. The teacher's role may then be taken over by a variety of student leaders.

4. Board Games: An old board game and spinner may be adapted for this activity.
   Spinner: used to establish the counting base of each game (2's, 5's, 10's)
   Board: most game boards will work (there should be a "home" that all players move their counters toward)
   board spaces should be numbered consecutively 1, 2, 3, 4, ...

Players: each of 4 players has coloured counters (one person has 4 blue counters, another has 4 red counters....)

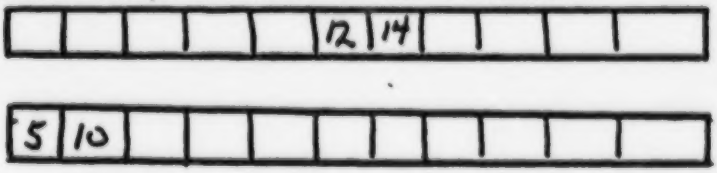
The Game: The game's counting base is established by spinning the spinner. Then, using a die, the first player moves 1 counter according to the throw. For example, a die throw of 6 (using the counting base of 2) would mean 6 jumps to land on 12... a die throw of 6 (using a counting base of 5) would mean 5 jumps to 30...

Players may start moving their next counter out and toward "home" as soon as they roll a "5" on the die.

Although the first person to get all 4 of their counters "home" is the player-winner, the game is not won until all counters are "home". The students are encouraged to help and cheer for each other.

5. Students are given follow-the-dot pictures to complete using counting by 2's, 5's, or 10's. Time is then given for students to make their own follow-the-dot pictures. These may be made into stencils for sharing. If possible, time should be allowed for picture colouring and arranging a wall display.

6. Several strips are drawn on the chalkboard.



The teacher "leads" completion of the first strip by filling in 2 or 3 of the spaces (keeping in mind that we are counting by 2's, 5's, or 10's). The teacher then asks the group to verbally chant the numbers that would fit in the strip spaces. This activity may continue with students taking over the teacher's role and just one student chanting the strip spaces rather than the entire group.

Let's Check: The students are asked to complete the following:

Let's Check

Name: _____

Count by 2's

___, ___, ___, ___, ___, ___, ___, ___, 50, ___, ___, ___, ___, 100.

Count by 5's

___, ___, ___, ___, ___, ___, 50, ___, ___, ___, ___, ___, 100.

Count by 10's

___, ___, ___, ___, 50, ___, ___, ___, ___, 100.

BASIC NUMERACY

Lesson 3: Grouping into 100's, 10's, 1's.

Materials: large envelopes, general

Teacher Preparation: Probe. Stencil

Let's Check. Stencil

Vocabulary: one, ten, hundred

Objectives: The student will demonstrate an understanding of 100's, 10's, and 1's grouping by:

- sorting articles into groups of 10's and 1's
- sorting articles into groups of 100's, 10's, 1's
- representing actual groups of articles pictorially and numerically
- regrouping 10's and 1's into 100's, 10's and 1's

Probe: The students complete the following as indicated by the sample.

Probe

Name: _____

A)

9	tens	6	ones	39
4	tens	0	ones	96
3	tens	9	ones	40

etc.

B)

4	hundreds	6	tens	2	ones	609
6	hundreds	0	tens	9	ones	690
6	hundreds	9	tens	0	ones	462

etc.

C) Fill in the blanks with "hundreds", "ones", or "tens"

964	9 _____	6 _____	4 _____
578	5 _____	7 _____	8 _____

etc.

Activities:

1. A) Students are each given a fairly large envelope. They are instructed to leave the class and collect as many small, inanimate objects as they can in 5 minutes. Upon their return, each student groups her articles into 10's and 1's. Class members are encouraged to help each other. Then each student tells the group "how many" she has collected. As this is being done, the teacher records on the chalkboard.

	10's	1's
Bill	4	3
Sue	2	1
Dan	7	0

All items are then gathered together. The class, as a group, divides these items into 10's and 1's. They may put their total on the chalkboard and check to see if it matches the total of individual groupings.

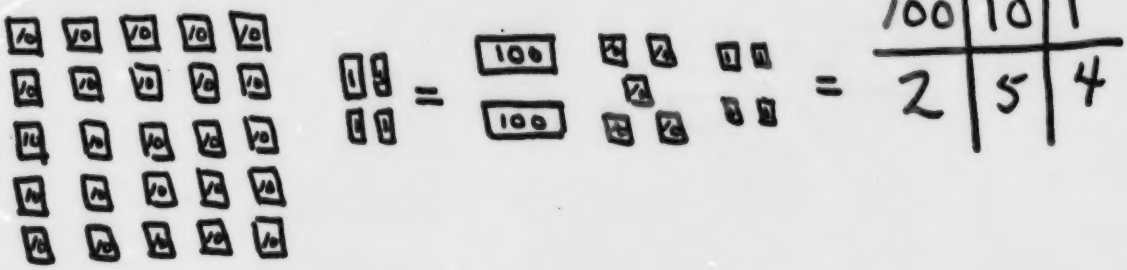
B) Each student is given an envelope (same ones as used in A) with a 2 digit number on it. The students must then go and collect the appropriate number of 10's and 1's. On their return, they must group their articles to show that they have in fact satisfied the requirement. As this is being done, a student records the groupings on the chalkboard.

2. Using all the items collected in Activity 1, the teacher and students divide the collection into groups of 10's and 1's. The teacher draws attention to the fact that there are more than 10 groups of 10. The group then counts by 10 to prove exactly how many items there are (of course, the 1's are added on).

At this point, the teacher must instruct the class: 10 groups of 10 is also 1 group of 100. Now, attention is returned to the collection.

The students physically group together 1 group of 100, groups of 10, and 1's. This is recorded on the chalkboard.

3. Chalkboard examples are worked. Groups of 10 are regrouped into groups of 100's, 10's, and 1's. This is begun by the teacher, then students give examples to each other.



4. On the chalkboard, drawings representing groups of 100's, 10's, and 1's are made. Working as a group, the students make the progression from -

to

100	10	1
3	3	3

to

333

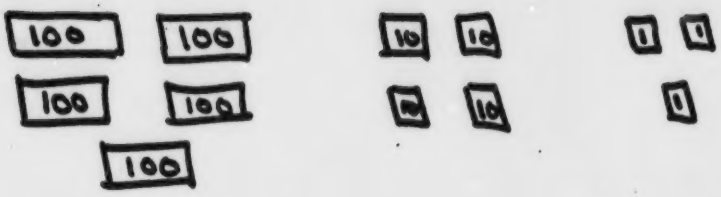
Several more group examples are worked on the board. The students are given turns to complete examples.

Let's Check: Approximately three of each type of example should be given.

Let's Check

Name: _____

A.



100	10	1

total ☐ etc.

B.

100's	10's	1's
3	9	6
7	2	0

→ ☐

← 274

→ ☐

etc.

BASIC NUMERACY

Lesson 4: Place Value and Expanded Notation

Materials: base 10 blocks, general

Teacher Preparation:

	Activity 6.	Stencil
	Activity 7.	Stencil
	Let's Check.	Stencil

Vocabulary: solve, expanded notation, ones, tens, hundreds, thousands, ten thousands, hundred thousands, place value

Objectives: The student will demonstrate understanding of place value (to 100,000's place) by -

- manipulating base 10 blocks and recording appropriate values
- identifying a written representation of an orally given number
- inserting commas appropriately in any given number
- positioning numbers to indicate greater or lesser value
- writing orally given numbers

Probe: The teacher reads 10 numbers (up to 100,000's place). The students write numbers to represent these. For example, the teacher reads, "three thousand, six hundred, and eighty-three" and the student writes 3,683. The teacher then reads numbers using expanded notation and the students record the appropriate number. For example, "four ten thousands plus six thousands plus five hundreds plus zero tens plus five ones" becomes "46,505".

Activities:

1. This activity involves manipulative materials such as "base 10 blocks".

   A) First, the students will each be given at least 15 unit blocks (1's). They sort these into groups of 10's and 1's. Then, each student takes his group of 10 and exchanges it for a "10-rod". Students now form pairs.

They combine there unit blocks and exchange any groups of 10 for a 10-rod. They record, on the chalkboard as below:

10's (tens)	1's (ones)	total
4	7	47

Students return all of the base 10 blocks.

B) Students are each given 15 rods and some unit blocks. Now, each student sorts his rods into groups of 10, individual rods, and 1's left over. Each student then exchanges each group of 10 rods for a "slab" valued at 100. Student pairs are formed, materials combined, and the resulting new groups of 10 rods are exchanged for slabs. The student will not be left with any rods. The new numbers are recorded, as in A)... there will be a 0 in the 10's place.

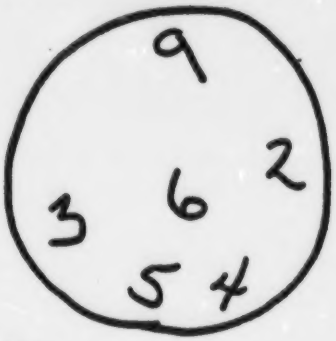
C) This same process is repeated using slabs exchanged for 1,000's blocks.

2. Time is spent with these materials. In student pairs, one sets up the blocks, the other "says" and records the number value. Roles are reversed back and forth.

3. Students are asked to write numbers, at random, on the chalkboard (between 2 and 5 digits). The teacher randomly reads these numbers. Students, in turn (one student just giving the chalk to any other student) circle the number read out. All students monitor this activity.

4. Using the overhead projector or a chalkboard, the teacher demonstrates how the use of commas/spaces make a large number easier to interpret. A student writes a number, no more than 6 digits, on the chalkboard. Another student places commas appropriately. The group then reads the number aloud. The activity is then repeated.

5. Jumbled Numbers: Students are shown jumbled numbers, randomly arranged on the chalkboard or overhead projector. For example:



They are asked to form:

A) The number of greatest value using two digits.

The number of least value using two digits.

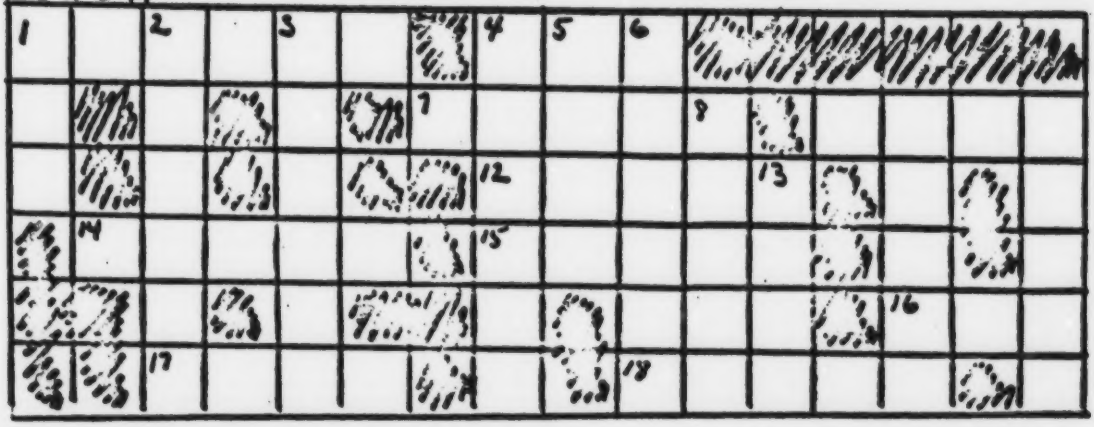
B) The number of greatest value using three digits.

etc.

6. Crossword Puzzle. The down and across numbers are read to the students. The students must fill in the spaces appropriately.

Across
1. 327,435
4. 346
7. 26,014
9. 6,341
12. 53,002
14. 32,245
15. 37,166
16. 346
17. 2,222
18. 66,541

Down
1. 367
2. 700,252
3. 307,493
4. 365,321
5. 4,037
6. 610,176
8. 40,636
10. 30,131
11. 17,562
13. 2,675



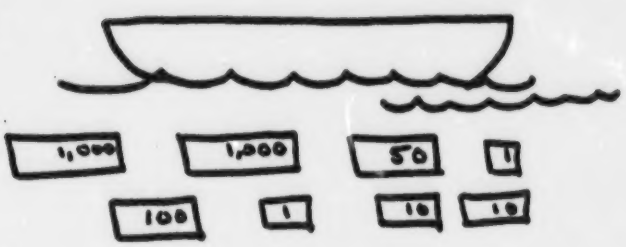
7. A) Initially, the teacher instructs: a number such as 1,982 equals 1,000 and 900 and 80 and 2. This is "expanded notation because we expand, or spread out, the number". Several examples are done on the chalkboard - students should be participating by giving the original number and expanding it. An assignment sheet is given with examples the following included:

8. An Assignment Sheet is given.

Assignment Sheet

Name: _____

A)



A man had to pay this much for a canoe. He had to pay _____ thousands + _____ hundreds + _____tens + _____ ones.

etc.

B) Give the missing digits.

a) 3,486 means _____ thousands, _____ hundreds, _____ tens, and _____ ones.

b) 1,294 means

c) 27,603 means.

etc.

c) a) 4,321

b) _____

c) _____

d) _____

e) _____

C) Directions:

The teacher reads numbers in expanded notation and the students record the actual number on the spaces provided on this Assignment Sheet. Some examples may be done on the chalkboard first. The expanded notation may be:

a) 4,000 + 300 + 20 + 1

b) 7,000 + 0 + 20 + 3

c) 9,000 + 400 + 60 + 0

d) 5,000 + 0 + 0 + 2

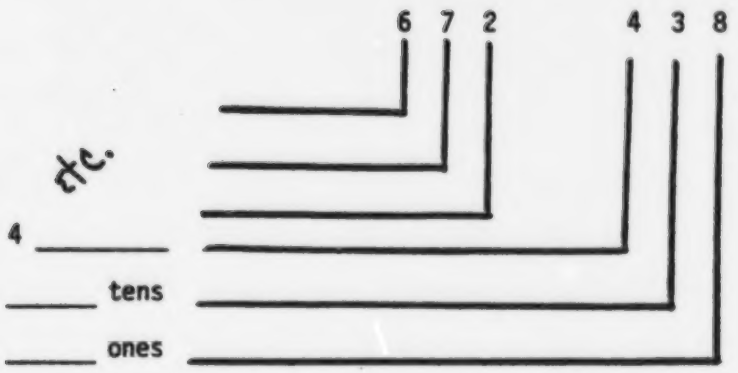
e) 80,000 + 500 + 30 + 7

Let's Check:

Let's Check

Name: _____

A)



Directions:

1. Fill in the _____.
2. Place a comma in the number.

B) Solve the equations by filling in _____.

a) 3,546 = 3,000 + 500 + 40 + _____.

b) 2,961 = 2,000 + 900 + _____ + 1.

c) 5,674 = 5,000 + _____ + 70 + 4.

d) 8,096 = _____ + 90 + 6.

e) 34,784 = _____ + 4,000 + 700 + 80 + 4.

BASIC NUMERACY

Lesson 5 Decimals

Materials: General

Teacher Preparation: Probe, Stencil
Activity 1, 2, 5, 7. Stencils
Activity 3. Expanded Notation cards
Activity 6. Fraction/decimal playing cards
Let's Check. Stencil

Vocabulary: decimal, point, tenths, hundredths, thousandths.

Objectives: The student will demonstrate an understanding of the concept of decimals by:

- converting a fraction to a decimal, using only the tenths place
- representing a decimal with a diagram
- interpreting expanded notation in order to place numbers appropriately in a place value grid
- matching decimals to corresponding fractions
- indicating inequalities by using $<$, $>$, $=$ appropriately
- appropriately placing orally given numbers on a place value grid

Probe: Each student is given an Assignment Sheet as follows:

Probe

Name: _____

A) Change each fraction to a decimal.

eg. 1. 9/10 = .9
2. 3 1/2 =
3. 6/100 =
4. 5 2/10 =
5. 125/1000 =

B) Give the correct sign (< or >)

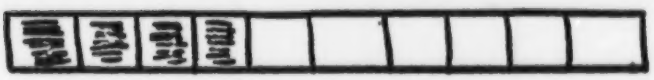
1.	5.9	___	5.09
2.	0.7	___	1.1
3.	0.999	___	1.001
4.	7.01	___	8
5.	0.01	___	0.1

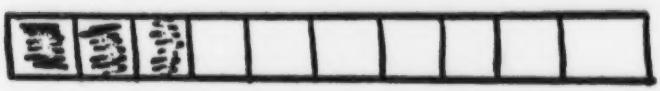
Activities:

1. Students are given a stenciled sheet on which is drawn:

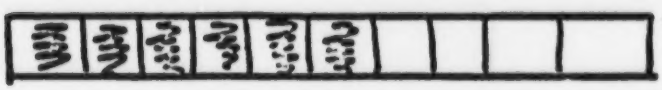
Assignment Sheet

Name:_____

A.  ___/10 = _____

B.  ___/10 = _____

C. ___/10 = _____

D.  ___/10 = _____

As a review of fractions, and an introduction to decimals students fill in the numerator in each diagram.

The teacher introduces the decimal point and explains that in A) 4/10 could also be written as .4 because, in decimals, the first place after the decimal point is 10ths of a whole number.

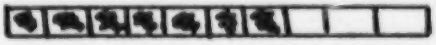
Students, working as a group, go back to the Assignment Sheet and rewrite each fraction as a decimal. For example, 4/10 becomes .4, or point 4. Additional stenciled sheets can be provided for practice.

2. An Assignment Sheet is given.

Assignment Sheet

Name: _____

Show the decimal by drawing a picture.

Example .7 

A) .6	B) .4
C) .5	D) .3
E) .8	F) .1

3. A) A large place value grid is drawn on the chalkboard. Students help with labelling the "places" left of the decimal point. The teacher then instructs that after the decimal point, the $10^{\underline{ths}}$ is the first place, so 4/10 could be written as .4 . A few more examples are worked by the group.

The teacher then labels the next decimal place the $100^{\underline{ths}}$ place, so 6/100 could be written as .06 (zero $10^{\underline{ths}}$ and 6 $100^{\underline{ths}}$). Several more examples are then worked with students having the opportunity to write $100^{\underline{ths}}$ place decimals on the grid.

The teacher then introduces fractions such as 38/100 and asks the students for suggestions as to how this would be written on the grid. She enters this and several similar examples on the grid. Then students participate by entering other decimal numbers on the grid.

This same process is repeated with the 1,000$\underline{\text{ths}}$ place.

While examples are being placed on the grid, the teacher draws the group's attention to the fact that 269/1,000 is also 2/10 + 6/100 + 9/1,000. To emphasize the place value, some examples using 0 should be given. For example, 29.006. At all times appropriate vocabulary should be stressed as in, "twenty-nine and six thousandths" or "twenty-nine point zero zero six".

B) Students now participate in a group game whereby, in turns, they choose a card - on which is written a decimal or, a whole number and decimal, in expanded notation form. For example,

300 + 60 + 9 + 3/10 + 6/100 or

200 + 40 + 3 + 2/10 + 6/100 + 1/1000

As each student selects a card, she reads it for the group (369.36), puts the card on display, then enters the number on the grid. The rest of the group act as helpers and monitors. The game concludes after all students have had several opportunities of number placement.

4. The teacher puts the following on chart paper. She states the numbers as she writes. The students watch and listen while she does this.

Students use a felt pen to match decimals with corresponding fractions.

5. The teacher quickly reviews greater than ( ) and less than ( ) with the students and prepares them for an Assignment Sheet by working several examples.

Assignment Sheet

Name: _____

Place the correct sign (< , >) in the ____

A.	.9	____	.09	E.	.006	____	.070
B.	1.36	____	1.26	F.	.200	____	.010
C.	43.0	____	43.1	G.	.987	____	1.
D.	64.21	____	642.1	H.	3/10	____	.36

etc.

6. Card Game (based on "Go Fish"):

60 cards are made.

dealing with $10^{\underline{ths}}$.

20 10 ---- .2, .4, .6, .9, .3, ...

10 ---- 2/10, 4/10, 6/10, 9/10, 3/10.....

20 dealing with $100^{\underline{ths}}$ same as ____

20 dealing with $1{,}000^{\underline{ths}}$ same as ____

Students sit in a circle and try to "pair" a decimal card with a corresponding fraction card. The game is over when all students have "paired" their cards.

7. Students are given individual place value grids. The teacher reads numbers aloud and the studetns place these numbers on their grids. The students may check their own completed grids by filling in a similar large grid on the board.

Let's Check:

Let's Check

Name: _____

A. Fill in each space

Fraction	Decimal
	.3
3/100	
365/1,000	
	.042

B. Circle the correct number

eg. 3.6 > (3.06) 4.00

2.9 = 2.09 2.90

14.01 < 14.10 14.00

26.56 > 26.056 26.65

13.04 = 13.400 13.040

BASIC NUMERACY

Lesson 6: Addition and Subtraction

Materials: general, dice, cardboard (any thickness), base 10 blocks, deck of playing cards, coloured counters - or white beans - or markers of some kind.

Teacher Preparation: Probe. Stencil
Activity 2. Stencil
Let's Check. Stencil

Vocabulary: add, adding, addition
subtract, subtracting, subtraction
solve, equation, sum, difference
example

Objectives: The student will demonstrate an understanding of the concept of basic addition and subtraction by:

- making the appropriate moves on a number line to illustrate equations
- by participating appropriately in a cumulative addition card game
- by arranging number cards to form true equations.

The student will demonstrate an understanding of the concept of regrouping in addition and subtraction by:

- manipulating rods and blocks to regroup 1's to 10's in specific addition problems
- manipulating rods and blocks to regroup 10's to 1's in specific subtraction problems.
- by identifying addition and subtraction answers (sum/difference) appropriately in a "Bingo" game.

Probe: The students are given an Assignment Sheet of 24 questions (12 addition, 12 subtraction). The questions involve simple addition, subtraction, and regrouping.

PROBE

Name: _____

A) $\begin{array}{r} 6 \\ +\ 3 \end{array}$ $\begin{array}{r} 5 \\ +\ 4 \end{array}$ $\begin{array}{r} 9 \\ +\ 3 \end{array}$ $\begin{array}{r} 33 \\ +\ 25 \end{array}$ $\begin{array}{r} 40 \\ +\ 16 \end{array}$ $\begin{array}{r} 45 \\ +\ 25 \end{array}$ $\begin{array}{r} 56 \\ +\ 29 \end{array}$

$\begin{array}{r} 75 \\ +\ 68 \end{array}$ $\begin{array}{r} 297 \\ +\ 362 \end{array}$ $\begin{array}{r} 937 \\ 560 \\ +\ 249 \end{array}$ $36 + 25 + 42 =$

$27 + 60 + 48 =$

B) $\begin{array}{r} 6 \\ -\ 2 \end{array}$ $\begin{array}{r} 8 \\ -\ 3 \end{array}$ $\begin{array}{r} 35 \\ -\ 20 \end{array}$ $\begin{array}{r} 76 \\ -\ 34 \end{array}$ $\begin{array}{r} 74 \\ -\ 38 \end{array}$ $\begin{array}{r} 80 \\ -\ 54 \end{array}$

$\begin{array}{r} 604 \\ -\ 372 \end{array}$ $\begin{array}{r} 752 \\ -\ 186 \end{array}$ $\begin{array}{r} 430 \\ -\ 290 \end{array}$ $\begin{array}{r} 641 \\ -\ 368 \end{array}$ $136 - 29 =$

$240 - 25 =$

Activities:

1. Number Line Walk

One - two students place wide masking tape along the floor, and with the teachers help divide this into even, walkable spaces. The spaces are marked off from 0 - 20. To demonstrate the procedure, the teacher tels the class that the operation is adding. The teacher rolls a die and one student stands on that number-mark on the number line.

The die is rolled again and the student must move the appropriate number of steps. While the student is moving, the other students are able to use their scratch pads, and/or base 10 blocks, to 'check' the student on the number line:

This activity is used later to illustrate subtraction.

With the teacher still rolling the die the students are told to either + or - steps. Once everyone has had a turn, student pairs are formed. In each pair one student moves along the number line the other rolls the die and decides the operation. The roller may use base 10 blocks or a scratch pad to monitor her partner. Roles are then reversed.

2. A) Personal Number Lines - Using regular masking tape, the students make their own number lines to be left on their desk tops. The number line could go up to 100. Each student could have a small counter to place on the number line. The teacher using 1, 2 or 3 dice calls some addition problems. These may be of several steps, such as 6 + 4 + 5 =. While the teacher is rolling the dice, she may simply look around to check "counter placement". This may be done for subtraction, then mixed problems with a student rolling the dice, and "calling out" the problem.

B) Several addition and subtraction equations are given to the students on a stenciled Assignment Sheet. They solve these using their personal number line. The students may work in pairs, individually, or in small groups.

3. Students cut out several squares of cardboard and on these write numbers 0 - 9, as well as the signs +, -, =. They then arrange the squares to see how many equations they can write. For example:

$$\underline{5} + \underline{3} = \underline{8}$$

Students may then form pairs or small groups, pool their cards, and make further, double digit equations. They may use their number lines to solve these equations.

4. Regrouping in addition is discussed. First, the teacher writes an addition problem on the chalkboard. For example:

	10's	1's
	5	9
+	1	7
	7	6

As she is doing this, she explains that 59 and 17 are really groups of 10 and 1's (this is actually a review). In adding the 1's first (the 7 and 9) the sum is 16 (1 group of 10 and 6 1's). Therefore, the 6 is written in the 1's column, and the 1 group os 10 added to the 10's column....making a total of 7 10's.

In order to reinforce the concept of regrouping, the students may work through this addition equation using base 10 blocks.

The teacher places a similar addition problem on the chalkboard. Together, the class interprets this equation using base 10 blocks and place value columns. Several such equactions are worked.

The students form co-operative pairs. The student pairs then solve a series of equations written on the chalkboard, or on a stenciled Assignment Sheet. Of course, base 10 blocks are made available to the students. Following several successful solutions, problems involving 100's may be worked.

5. Cumulative addition. For this game, the group sits in a circle. The teacher, using a deck of playing cards with the "face" cards removed, pulls a card. The states as well as shows the number cards, then offers the deck to the student next to her. That student pulls a card and adds the number card onto the teacher's card. The game continues round the circle. After each person's turn, she places the number card, face up, in front of her. In this way, if any confusion arises, a quick tally will be possible. In order for students to add, they may use a variety of aids (number lines, scratch pads, blocks...). Students are encouraged to help each other if needed.

6. Activities 1 and 2 may be adapted for subtraction.

7. Regrouping for subtraction. The teacher writes a subtraction problem on the chalkboard. For example:

10's	1's
8	2
- 6	5

While she is doing this, she draws the group's attention to the place value columns. Now, the solution is attempted. First, it is established that 5 cannot be taken away from 2. It is reviewed that 82

means 8 groups of 10 and 2 1's. Therefore, it is possible to take a group of 10, break it into 1's and use it in the place value column specified for 1's. Adding that broken group of 10's to the 1's already in the column, the total is found to be 12. The problem is now easy to solve. ... 12 - 5 = 7. In the 10's column, there are 7 groups of 10 left on the top. Finally, 7 - 6 = 1.

After examples such as the one given have been worked with the group, new equations are written on the chalkboard. Student pairs, using aids if wished, solve these problems. If the teacher wishes, these equations could be written on a stenciled Assignment Sheet.

If required the students may participate using base 10 blocks, in a short activity breaking groups of 10's. For example, some chalkboard equations may be:

Fill in the blank _____

a) 26 = 1 ten and ___ ones

b) 33 = 2 tens and ___ ones

c) 52 = ___ tens and 12 ones

d) 91 = ___ tens and 11 ones

e) 105 = ___ tens and 15 ones

8. Bingo: The class creates a large chart of addition/ subtraction facts to 100. Then, the students are given a square of cardboard - large enough to draw 25 squares (5 across, 5 down). The students, using the chart, write a sum or difference in each square. Each student may do more than one card.

For the game, each student draws a Bingo card. The teacher initially acts as caller. She randomly calls addition/subtraction facts. If the student has the answer (sum/difference) on her card, she covers it with

a marker. The first person to have "Bingo" may become the next caller. What "Bingo" entails may be established by the caller at the start of each game. For example, markers in a horizontal, vertical, or diagonal line.... or perhaps, an entire card covered by markers.

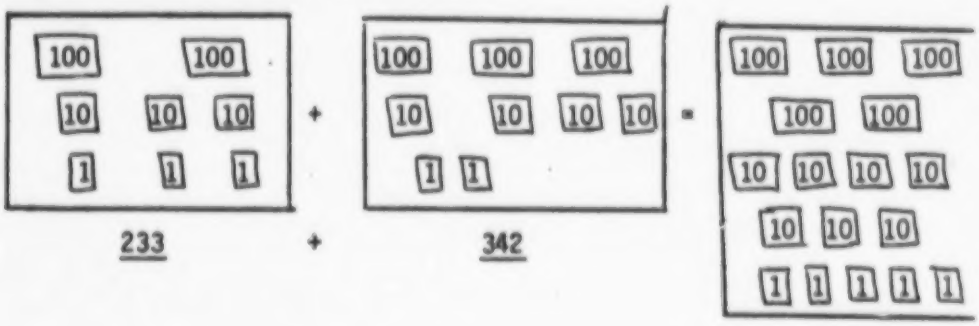
Let's Check:

Let's Check

Name: _____

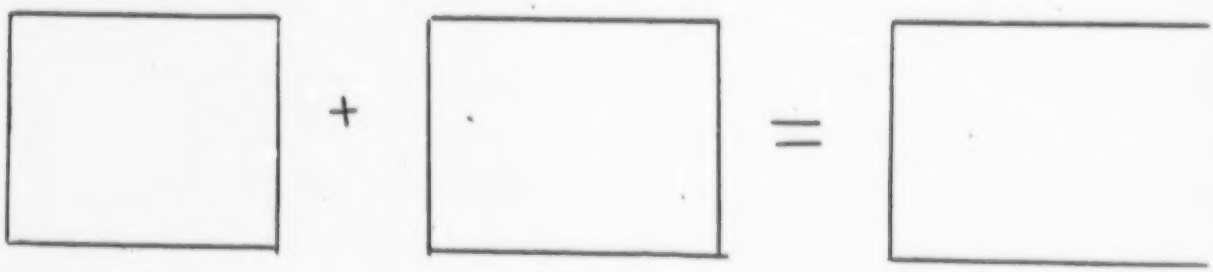
A) Solve the equations like the example given:

example:



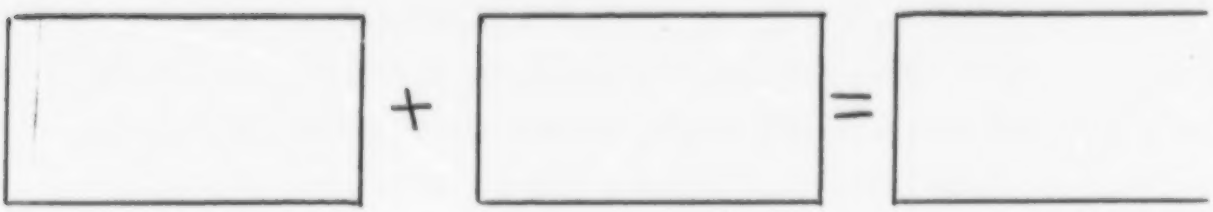
233 + 342 = 575

equation: 233 + 342 = 575



____ + ____ = ____

equation: ____ + ____ = ____



_____ + _____ = _____

equation: _____ + _____ = _____

B)
$$\begin{array}{r} 3 \\ 42 \\ +\ 129 \\ \hline \end{array}$$

40 + 260 + 9 =

396 + 20 + 14 + 2 =

C) Fill in the blank _____

42 = 3 tens and ___ ones

122 = ___ tens and 13 ones

39 = ___ tens and 19 ones

D)
$$\begin{array}{r} 9 \\ -\ 4 \\ \hline \end{array} \qquad \begin{array}{r} 32 \\ -\ 17 \\ \hline \end{array}$$

97 - 68 =

432 - 196 =

BASIC NUMERACY

Lesson 7: Pre-Times Tables (Multiplication)

Materials: general, counters - or other small objects (all the same)

Teacher Preparation: Activity 5. stencil

Vocabulary: multiply, times, (x or ·), product

Objectives: The student will demonstrate the grouping principle of multiplication by:

- counting groups of actual and visualized objects
- arranging objects in appropriate groups and identifying "how many" in each group, "how many" groups, and "how many" objects in total.
- using the multiplication signs (x) (·) appropriately

Probe: The teacher writes the following questions on the chalkboard. The students copy them onto paper and solve.

A) $\begin{array}{r} 5 \\ \times\ 2 \\ \hline \end{array}$ $\begin{array}{r} 3 \\ \times\ 4 \\ \hline \end{array}$ $\begin{array}{r} 8 \\ \times\ 2 \\ \hline \end{array}$ $\begin{array}{r} 9 \\ \times\ 1 \\ \hline \end{array}$

B) 0·7 = 4 · 5 = 2 · 4 =

C) Find the product of

6,4 _____ 3,8 _____ 2,9 _____

Activities:

1. Teacher asks "How Many Students?" reply _____

"How Many Feet does each student have?" reply _____

"How Many Feet altogether?" reply _____

Teacher then illustrates this on the board, drawing feet and counting..... stressing for example, eight groups of 2.

Teacher may then go on to other examples such as hands, shoes, fingers..... always stressing groups of ._____.

2. The teacher asks the students to relax (some relaxation exercises may be used) and close their eyes. They are asked to imagine 5 people that they really like. "Now, see yourself giving 2 cookies to each of those people. How many cookies would you give away?" After a few moments, the students may open their eyes and talk about it.

   Next, after closing their eyes again, the students are asked to imagine those same people - but this time they can give them any number of cookies each. When the students open their eyes, they share:

   - how many cookies were given each person
   - how many cookies were given in total

3. The teacher and students go outside. Some students may go to the bicycle rack, some may go to the car park. The assignment is to count how many vehicles, then count how many wheels on the vehicle. One student from each of the 2 groups acts as the information recorder. Everyone then returns to the classroom. Now, each group draws the cars or bicycles on a chart. There is space on the chart to fill in number of groups, number in each group, and totals. For example:

Some Vehicles at Mount Newton Middle School

9 cars: etc.

4 wheels on each car

9 groups of 4 = 36

26 bicycles: etc.

2 wheels on each bicycle

26 groups of 2 = 52

The class proceeds with a group discussion, helping each student to understand that what has taken place is merely the grouping of numbers.

4. The students are given a pre-determined number of counters. Each student is given a different assignment. For example, one student must make groups of 5, another must make groups of 3, etc., (there should not be any "leftover"). When the grouping is completed, the students must count how many groups, how many in each group, and the total number of objects. While the students are "grouping", the teacher writes on the chalkboard:

Name	Number of Groups	Number in Each Group	Total Number of Objects

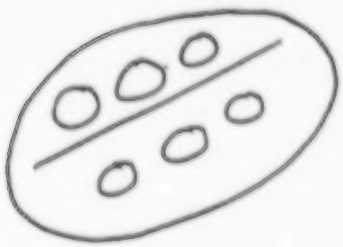
The students then, in turn, come to the chalkboard and fill in the spaces. From the information on the chalkboard chart, the teacher can create equations in the following way:

_____ groups of _____ = _____

The teacher then asks the class if there could be an easier, faster way of solving these kinds of problems. The teacher explains that when we add several groups, each group with the same number of things in it, we can simplify the process by "multiplication" "x" ".".

As a group, the class does some examples like the following:

(on the chalkboard, the teacher draws and writes)



2 groups of 3 = 6

2 × 3 = 6

The teacher encourages the students to participate in creating and solving the equations. Some multiplication problems involving 0 should be given. Although not necessarily stressed, it should often be mentioned that the answer is called the "product".

5. The students are given an Assignment Sheet similar to the examples done on the chalkboard in the previous activity. The students may work alone or in pairs. Counters of some sort should be available in order to aid the process.

Let's Check:

As in "Probe", the teacher writes the following questions on the chalkboard. The students copy them onto paper and solve.

A)
$$\begin{array}{r} 4 \\ \times\ 2 \\ \hline \end{array} \qquad \begin{array}{r} 3 \\ \times\ 3 \\ \hline \end{array} \qquad \begin{array}{r} 8 \\ \times\ 2 \\ \hline \end{array} \qquad \begin{array}{r} 9 \\ \times\ 0 \\ \hline \end{array}$$

B) $4 \cdot 4 =$ $3 \cdot 4 =$

C) Find the product of

3,2 _____ 7,2 _____ 5,3 _____

BASIC NUMERACY

Lesson 8: Multiplication

Materials: general, graph paper, counters, playing cards, dominoes, dice, base ten rods

Teacher Preparation: Probe. Stencil

Vocabulary: product

Objectives: The student will demonstrate an understanding of the principle and concepts involved in multiplication:

- by arranging counters into multiplication groupings and writing an appropriate equation for each display
- by visualizing a multiplication problem
- by solving multiplication problems using 10 and 100
- by solving multiplication problems - in a card game situation, using multiples of 10 and 100.
- by creating story problems (2 digits by 2 digits) and solving these with teacher's guidance
- by completing an Assignment Sheet involving 2 digit by 2 digit multiplication
- by participating in a game, using dice, finding the products of 2 digit by 2 digit multiplication
- by working examples of 3 digit by 3 digit multiplication, on graph paper, with teacher guidance
- by arranging dominoes to form 3 digit multiplicand and multiplier, and finding the product.

Probe: The students complete the following stencil.

PROBE

Name:_____

Find the product for each question:

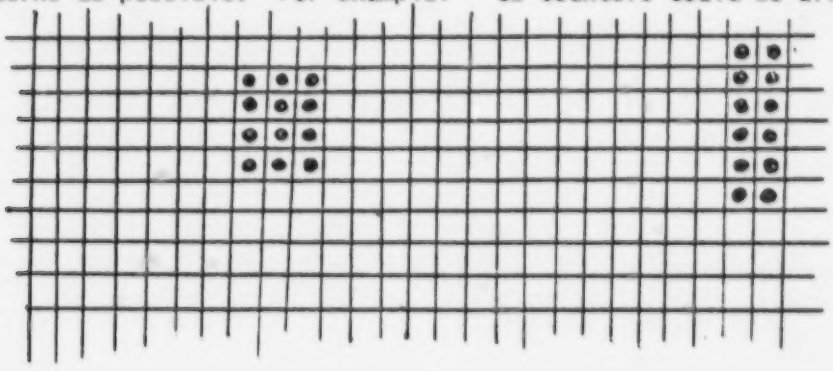
99	47	22	65	275	382
x 3	x 8	x 9	x 6	x 5	x 7

269	768	309
x 70	x 64	x 68

If required, the teacher may quickly review concepts developed in the pre-times table section.

Activities:

1. Students are each given a large square of graph paper and varying amounts of counters. They are asked to arrange these in as many different patterns as possible. For example: 12 counters could be arranged as below:



After the arrangement is completed, the students write the equation, and repeat the process. For example, the equation for the above arrangements may be:

4 x 3 = 12 2 x 6 = 12

Students may then form pairs and pool their counters, arranging them into more multiplication patterns on graph paper and recording the corresponding equations. The students may work as a team or one student may arrange the counters, the other might write the equation.

As an alternative, students could arrange their counters in a display, then all students would circulate and write an appropriate equation, on their scratch pads, for each arrangement.

2. The students participate in a visualizing activity. The students are asked to close their eyes and visualize a canoe race. "If there are _____ people pulling each canoe, and _____ canoes in the race, can you see how many people would be pulling canoes in the race altogether. Discussion commences. This scene could be illustrated on the chalkboard - in order to facilitate a solution.

3. A) This activity involves multiplying by 10 and 100. Students are instructed that when multiplying by 10, all they must do is add a 0 ... and when multiplying by 100, add 2 0's.

Several problems involving multiplication by 10 are written on the chalkboard. Each problem is worked first by grouping to solve, then by merely adding 0. Conclusions are drawn as to which seems to be the faster and easier method.

As a group, students arrange base 10 rods to conform with equations. This confirms that the previous grouping method was correct and reinforces the background information needed to feel confident in adding 0 when multiplying by 10. This process is repeated using 100.

B) A card game using a deck of playing cards (1 - 9) takes place as a group activity. All the students sit at their desks, or on the floor. One student is given the deck of playing cards, she pulls a card from the deck. The student then states what the product would be if the number was multiplied by 10, by 100. For examply, if 9 was the playing card pulled, the student would show the card, then state 90, then 900. The deck of cards is then passed to any other person that the student chooses. If necessary, students may use the chalkboard or scratch pads to actually add the 0's to the number. Later, this should not be needed. This game may then lead to a student pulling 2 playing cards, finding the product, then adding the zeros (multiplying by 10, then 100). For example:

3 x 6 = 18 , 18 x 10 = 180 , 18 x 100 = 1,800

A variation may be:

3 x 6 = 18

3 x 60 = 180

3 x 600 = 1,800

4. The students are presented with a problem that leads to 2 digit by 2 digit multiplication. For examply:

There are 24 slices of bread in a loaf, and we know that the families coming to our party will eat 15 loaves. How many slices of bread will they eat altogether? The group attempts to solve the problem. Instruction on the chalkboard involves:

24
X1

Step 1. To begin, the teacher multiplies by the digit on the right, lower number. The student may do the same, using graph paper to align the numbers.

Step 2. Consideration is given to the second digit of the lower number. With a quick review of place value, the students are

reminded that the digit in the second place represent 10's. A 0 is then placed in the 1's place value column to signify the move to the next column (multiplying by 10's).

More examples are worked on the chalkboard..... These examples may come from stories offered by the students. All students are encouraged to participate in finding the product by verbally working the problem with the teacher and solving the problem on their graph paper.

Students are then asked to solve, on their graph paper, 5 multiplication questions (2 digits by 2 digits) that are written on the chalkboard. Time is given for completion, then these same problems are solved on the chalkboard. If the students feel confident, they may actually solve the problems at the chalkboard themselves.

5. The students form pairs in order to participate in a dice game. The first student throws 2 dice to determine the "multiplicand" and the second student throws the dice to determine the "multiplier". Working as a team, the students write down the established problem and find the product.

   This is repeated several times, the teacher acts only as a resource person. The students show the teacher their work once they feel confident that they have mastered the concept.

6. A) The students now encounter multiplication involving 3 digits by 3 digits. The students observe the teacher multiplying 3 digits by 3 digits, as the example below suggests.

$$\begin{array}{r} 546 \\ \times\ 123 \\ \hline 1638 \\ 10920 \\ 54500 \\ \hline \end{array}$$

Again, place value is stressed, with attention being drawn to the fact that as the second digit represents the 10's place, the third digit

represents the 100's place. Therefore, the 0's may be used to fill in the vacant spaces (see example above). Again, several examples are worked and the students may then solve some chalkboard problems (graph paper is made available).

B) One student is designated the "shaker" of 3 dice. After shaking, the result is written on the chalkboard as the multiplicand. The shaker then uses the same method to determine the multiplier. The multiplier is written on the chalkboard under the multiplicand.

The students use their graph paper to determine the product. When students are confident with the operation, they may volunteer to work the chalkboard problem. Several such questions are solved with different students acting as the "shaker".

7. The students receive more 3 digit by 3 digit multiplication practice by using dominoes. The dominoes are aligned 3 across so that the top half represents the multiplicand and the lower half represents the multiplier. The students may work alone or in pairs.

Let's Check: The following questions are written on a stenciled Assignement Sheet. The students may use times-table charts in order to complete the problems.

Let's Check

Name: _____

59 x 10	73 x 60	76 x 10 =
		76 x 100 =
65 x 23	89 x 67	39 x 10 =
		39 x 100 =
473 x 263	861 x 703	25 x 10 =
		25 x 100 =

BASIC NUMERACY

Lesson 9. Division

Materials: general, waxed paper, iron, base 10 blocks, peanuts

Teacher Preparation: Activity 7. Number cards
Activity 6. Stencil
Let's Check. Stencil

Vocabulary: Divisor, quotient, remainder, evenly, dividend

Objectives: The student will demonstrate an understanding of the concept of division by:

- physically dividing objects into groups, evenly and with a remainder
- illustrating and solving division problems
- finding all possible divisors for a given number
- participating in a card game

Probe: The following questions are written on a stenciled sheet for the students to answer:

PROBE

Name: _____

Find the quotient.

$2\overline{)82}$	$99 \div 3 =$	$4\overline{)49}$	$11\overline{)66}$	$32\overline{)692}$
$72 \div 12 =$	$11\overline{)100}$	$15\overline{)75}$	$369 \div 123$	

Activities:

1. Students are asked to close their eyes and visualize 4 people in their family sharing 12 corn cobs at supper-time. How many corn cobs each?

Following discussion, students are asked to visualize the same 4 family members, but this time they only have 10 corn cobs to share. Would there be enough to divide evenly, without breaking any cobs? Would there be any cobs left over?

Discussion centres on the fact that sometimes, in division, there may be things left-over - or remaining.

2. The teacher introduces the principle of division by stating "I have ____ peanuts and there are _____ students. If I share them evenly, how many peanuts will each student get." The students speculate, the teacher then divides the peanuts evenly until all are distributed.

   Discussion includes: - how many students - how many peanuts given out - how many peanuts did each student get.....
   The teacher then represents this on the chalkboard as a division problem.

3. Students form pairs. Each pair is verbally given an assignment, such as divide these 28 books among 4 bookshelves so that each shelf gets the same number of books. The group then gets together and students, with teacher's help, verbalize the total number of articles they had to work with, how many groups they were divided into, and how many each group received. As the students relate their assignment tasks to the class, the teacher writes the various division problems on the chalkboard. The students involved may help answer the division problems, based on the knowledge gained from their recent experience.

4. Some division problems from Activity 3, are closely examined. For example, the books and the bookshelves:

   On the chalkboard -

   bookshelves $4\overline{)28}$ books — 7 each shelf

   $\underline{28}$

   0

As the teacher writes the problem, she explains, "We divided 28 books among 4 bookshelves and there were no books remaining. We know this because 28 - 28 = 0." The teacher elaborates using another example. "If there were 30 books to be divided among 4 shelves, there would still be 7 books on each shelf, but there would be 2 books remaining." This example could first be worked with actual books and shelves, then on the chalkboard.

$$\begin{array}{r} 7 \\ 4\overline{)\,30} \\ \underline{28} \\ 2 \end{array}$$

Using the above example, the teacher could emphasize the new vocabulary.

For example: The 4 is the divisor

The 30 is the dividend

The 7 is the quotient (the answer)

The 2 is the remainder

5. A) The teacher assigns a number to each student. The students go outside and collect the corresponding number of leaves (or some other item that is easily found and its removal would not disrupt the environment). This should take about 10 minutes.

The students return to the classroom, form student pairs, and divide their leaves into 2 even groups. Each student pair writes a division problem for this operation. The teacher draws the groups attention to problems that have a remainder. She uses these for examples regarding vocabulary review.

Each student pair then divides their leaves into groups of 3, 4, 5, etc., and write appropriate division problems to illustrate the procedure. Several of these problems may be used by the teacher to review vocabulary.

B) The group combines all of the leaves, then counts to see how many leaves they have altogether. The group then counts the windows in the classroom and decides how many leaves can be used for each window. This may be done by solving a division problem on the chalkboard. Then, the students divide the leaves into the appropriate piles. Now, the students make decorative window pictures. They must arrange the leaves on a piece of waxed paper, place another piece of waxed paper overtop, then iron it with a heated iron. It is best to have a piece of newspaper between the waxed paper and the heated iron. The waxed paper will bond together with the leaves in between. Frames may be made, then these pictures are scotch taped to the windows. These may be very complex and decorative.

6. The students are given a stenciled sheet.

ASSIGNMENT SHEET

Name: _____

Find the quotients. All have remainders.

$3\overline{)7}$ $2\overline{)9}$ $4\overline{)13}$ $5\overline{)21}$ $9\overline{)88}$ $7\overline{)52}$

$6\overline{)41}$ $8\overline{)40}$ $66 \div 8 =$ $35 \div 4 =$ $17 \div 2 =$ $26 \div 6 =$

The teacher may solve the first problem on the chalkboard, as a procedure review. Attention should be drawn to the two different emthods of writing division problems.

7. Activity 7 is a card game. 4 players

A) cards, from 1 - 15 (4 of each number)

B) cards, from 6 - 40 (each should have 4 factors so these cards would be 6, 8, 10, 14, 15, 21, 22, ...)

The game: Each student chooses a card from B).

Cards from A) are dealt to the players,

Each student must decide if the number shown on her card is a divisor of the number she originally drew. If it is, she keeps it, if not, it is returned to the bottom of the pile. The game is completed when all students have found all 4 possible divisors of her original number. Once a student has completed her 4 divisors, she may help a fellow student, advising her to retain or discard a number card.

8. Student pairs are formed. Each student creates a division problem. Students trade papers and illustrate the problem using dots, base 10 blocks, unifix cubes, etc., then solves the problem with a written procedure. Students may, at any time, aid each other.

9. On the chalkboard, the teacher reviews the steps needed in solving division problems. At this point, the students may attempt to solve 2 digit divisor and 3 digit dividend problems. Several examples should be done while the students watch. Next, the students should imitate, on scratch pads, the teacher's procedural steps. Finally, the students may try division problems on their own. The teacher acts as a resource person now. When the students feel confident that they have completed 5 problems correctly, they may show these to the teacher. All of the division problems needed for this activity may be written on the chalkboard. Some of these problems should be written $\overline{)}$, some $\div$.

Let's Check:

LET'S CHECK

Name: _____

Rewrite these division problems and solve.

36 ÷ 6 = $6\overline{)36}$ = _____

42 ÷ 7 =

56 ÷ 8 =

64 ÷ 8 =

72 ÷ 9 =

24 ÷ 6 =

63 ÷ 9 =

35 ÷ 5 =

48 ÷ 8 =

99 ÷ 11 =

ESTIMATING ROUNDING AVERAGING

Materials: popped corn, straight-sided transparency, large jar, timer, several itemized grocery cash register tapes, calculator, restaurant menus, stop watch, general, 2 decks of playing cards.

Teacher Preparation: Probe. Stencil
Activity 1. Stencil
Activity 3. Pop-corn-popped
Activity 7. Stencil
Activity 8. Chart
Let's Check. Stencil

Vocabulary: estimate, round, average

Objectives: The student will demonstrate the understanding of the concepts of estimating and rounding by:

- estimating the amount a container will hold, using a sample portion
- using a number line to determine whether to round up or down (multiples of 10 and 100 are used)
- completing an Assignment Sheet, rounding to the nearest 10,100,1000
- estimating the number of tasks completed in 5 minutes when the sample portion in 1 minute.
- by estimating the total cost of items using grocery store tapes, and comparing this to actual cost
- using estimating as a device for checking answers

The student will demonstrate the understanding of the concept of averaging by:

- filling in a chart with personal information
- averaging the time it takes all students to complete a given activity
- finding the average of a given number while participating in a card game.

Probe:

PROBE

Name: _____

A) Round this number - 23,639

to the nearest 10 _____

to the nearest 100 _____

to the nearest 1,000 _____

B) Fill in the ____

To estimate 56 + 83, we add _____ + 80

To estimate 8 x 79, we multiply 10 x _____

To estimate 406 - 298, we subtract 400 - _____

To estimate 137 + 17, we divide _____ + 20

C) Find the average for each

23, 17, 46, 24, 15 average = ____

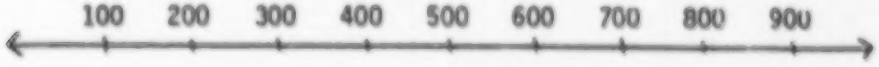
9, 6, 1, 8, 7, 5 average = ____

16, 11, 9, 4 average = ____

Activities: When appropriate, a calculator may be used. This, of course, is left to teacher discretion.

1. A) The teacher draws a number line on the chalkboard. Various individual numbers are considered by the students. They must decide whether a number is closer to the preceeding or following multiple of 10. For example, would 36 be closer to 30 or 40? The students may use their thumbs to indicate whether to round up (thumbs up) or to round down (thumbs down). Some examples should be midway between 2 multiples of 10. The teacher explains that in such cases, 35 for example, we always round up.

B) All students are given a stenciled Assignment Sheet such as:



	Round up	Round down		Round up	Round down
a. 326			f. 750		
b. 681			g. 254		
c. 540			h. 444		
d. 135			i. 820		
e. 892			j. 650		

The students complete the Assignment Sheet, as a group, in the following manner.

- They place the given numbers on the number line by marking the line with the corresponding letter.
- The group forms a concensus on whether each number should be rounded up or rounded down, using of course multiples of 100

For example:

	Round up	Round down
A. 326		✓

2. The students complete an Assignment Sheet.

ASSIGNMENT SHEET

Name: _____

A) Circle the right number:

3,862

- Rounded to the nearest 10 is 3,860 / 3,870
- Rounded to the nearest 100 is 3,800 / 3,900
- Rounded to the nearest 1000 is 3,000 / 4,000

B) Circle the right number:

6,858

- rounded to the nearest 10 is 6,850 / 6,860
- rounded to the nearest 100 is 6,800 / 6,900
- rounded to the nearest 1000 is 6,000 / 7,000

In order for the students to experience success, the teacher may lead the group in a part A) perusal in the following manner:

- The teacher reads aloud each statement. If the student thinks it would be the top number, she would hold up her index finger from a closed fist. If the student thinks it would be the bottom number, she would keep her fist closed. In this way, the teacher can easily see if all students understand and are able to complete the Sheet. At any time, the teacher may review or clarify relevant concepts. Then, the students may complete B) as the teacher circulates.

3. Estimating

A) The teacher poses the question, "How many pieces of popped corn could we fit into this jar. The students consider various possibilities (wild guesses) and then, with teacher direction, decide to actually fill the jar and count the corn. When counting the corn that filled the jar, several students may count small piles. Using the chalkboard, the group works out the total number of popped corns by adding the students' subtotals. This total is recorded on the chalkboard.

Discussion centres on how long this took and the group tries to discover or suggest an easier method.

B) The teacher marks, with tape or felt pen, the jar at even intervals:

The students fill the jar to the first mark. They then dump out the corn, and count the number of kernals. By rounding this number to the nearest multiple of 10 (23 would become 20, for example), and multiplying this by the number of intervals, the students would estimate the number of kernals needed to fill the container. (This "estimated" number is compared to the number found in A).

The students and teacher discuss how much faster the second method was, and how close the totals were. The teacher explains that in many situations a rough estimate is helpful. This is especially true in dealing with quantity, time, or money.

4. Each student in the group is assigned a task. For example, a task may be stacking books or sharpening pencils (jobs which actually need to be done at the time, if possible). Each student keeps a careful count of "how many" she can do before the timer signals the end of 1 minute. Now, knowing how many is possible in 1 minute, the student estimates how many she can do in 5 minutes.

A group chart is then prepared stating:

Student's name
Task description
How many done in 1 minute
How many done in 5 minutes
How many done in 1 hour

> Estimation

5. The teacher explains, with examples, that estimation can be used for mathematical operations:

   To estimate 98 + 49 we can think 100 + 50

   To estimate 92 - 19 we can think 90 - 20

   To estimate 47 x 52 we can think 50 x 50

   To estimate 719 ÷ 9 we can think 720 ÷ 10

   While the teacher performs these operations, she explains that in order to estimate, we "round off".

6. A) Estimation is useful when shopping. Using an itemized cash register tape (apples $2.54, etc.), one student reads out the amount, the group rounds it off to the nearest dollar and a second student records it on one side of the chalkboard. A third student records the actual amount on the other side of the chalkboard. When all item prices have been recorded, both rows of figures are totalled, then compared. It is stressed that people often mentally estimate the total cost of the items on their grocery list before they go shopping. This way they can tell about how much they will spend. People will know if they have enough money to buy all the things they want, or, how much money to take to the store.

   B) Students are given a section of cash register tape (about 5 items) and a fictional amount of money to spend. By a process of rounding the cost of each item, they decide whether their allocation of "grocery money" is sufficient.

   A similar activity could include using restaurant menus. Would the fictional money be enough to pay the bill? What could you eat for dinner, (you only have _____ amount of money)?

7. Discussion is initiated, by the teacher, regarding estimation as a useful method in checking answers. Several examples are placed on the chalkboard each with a column for estimation and a column for actual numbers.

For example:

33 x 18

Estimation	Actual
30 x 20 600	33 x 18 264 330 594

There should be some discussion comparing the 2 answers and how the students feel they could use this procedure. An Assignment Sheet is given to all students. The first 3 questions will have the "estimation" column partially filled in, then the students must fill in their own estimation equation.

ASSIGNMENT SHEET

Name: _____

47 x 9	
Estimate: 50 x 10	Actual:
78 ÷ 19	
Estimate: 80 ÷ 20	Actual:
561 + 341 + 783	
Estimate: 570 + 340 + 780	Actual:
962 - 48	
Estimate:	Actual: etc.

Before commencement, it should be determined whether all numbers should be rounded to the nearest multiple of 10 or, some numbers rounded to the nearest 100.

8. A large chart is displayed. The students discuss various things that they have in common, and some of the ways they differ. Each student, in turn, is given a chance to fill in - on the chart, their name and other pertinent information. An example of such a chart:

Name	Height in cm	# of Sisters	# of Brothers	Age	# of pencils in case	# of min. to get home	etc. other personal info.
Total							
Average							

The students may decide on a title for the chart.

Then, the group totals each column. The teacher initiates a short discussion as to what an "average" is.... The students then divide all of the totals by the number of students in the group. The average for each informational column is then recorded on the chart.

9. In a non competative way the students, using a stopwatch (some instruction may be needed in order for all class members to feel comfortable with this device), time how long it takes each one to walk around the school (or some other destination). Each "time" is recorded on the chalkboard, then the average is found.

10. Using 2 decks of playing cards (face cards being worth 10) 5 cards are dealt to each student. The remainder is piled in the centre. The "average" is designated by the first card (5 or above) being turned over from the remainder pile. The students take turns drawing a card from the pile, or from other students' discards. As soon as an individual has acquired the total in her hand of which the designated number is the average, and this is confirmed by the group, the student places the hand to one side and takes 5 more cards from the pile. When 5 such piles have been amassed by the group, the game is over, a new "average" is selected, and the game begins anew.

As a variation, each student could have an individual average to find.

Let's Check:

LET'S CHECK

Name: _____

A) Estimate answers for the following

393 + 407 = _____
685 + 317 = _____
468 - 233 = _____
803 - 267 = _____
34 x 28 = _____
42 x 53 = _____
74 ÷ 8 = _____
237 ÷ 7 = _____

B) Find the average:

3, 7, 4, 6 _____
9, 11, 7 _____
35, 41 _____
20, 35, 44 _____

MEASUREMENT

Lesson 1: Weight

Materials: general, trays of miscellaneous items - similar in weight (may be taken from the big box of odds and ends), balance scale, gram weight, kilogram weight, metric kitchen scales, empty product boxes (cornflakes, laundry soap...), sand or beans, potatoes, tea cups.

Teacher Preparation:

Probe.	Stencil
Activity 3.	Stencil
Activity 4.	Find a simple "metric" recipe
Let's Check.	Stencil

Vocabulary: grams, kilograms, abbreviations g and kg, instructions

Objectives: The student will demonstrate an understanding of the concept of measurement by weight by:

- using estimation to range objects from lightest to heaviest
- using estimation in collecting objects less than a specific weight, greater than a specific weight, and equal to a specific weight
- using a balance scale to compare object weights to kg
- using a balance scale to determine the quantity of given objects to balance 1 kg.
- weighing ingredients for a recipe (using kitchen scales)
- identifying the weight on product packages and weighing a corresponding amount of sand/beans
- weighing objects on kitchen scales and recording the weight.

Probe:

PROBE

Name: _____

A) Directions: Put a ✓ in the right place. You may weigh these items first.

	heavier	lighter	
a) A textbook is			than 20 g
b) A blackboard eraser is			than 50 g
c) A piece of chalk is			than 10 g
d) A package of felt pens			

B) Weigh, and record the exact weight of:

a) a stone _____

b) a pencil box _____

c) a pair of scissors _____

d) a container of glue _____

e) 2 apples _____

(necessary items are provided)

C) Add:

a) 300 g
430 g
+ 390 g
= _____ kg _____ g

b) 666 g
214 g
+ 522 g
= _____ kg _____ g

c)

kg	g
1	30
6	90
+ 2	25

= _____ kg _____ g

Activities:

1. Each student pair is given a tray of items similar in weight. Using estimation, they arrange these items from lightest to heaviest. (These items may include a penny, cork, pencil, paint bruch, crayon, piece of chalk, pine cone, ruler, marble, spool of thread .....) Students draw these items on strips of paper, as arranged from lightest to heaviest. In turns, pairs go to the balance scale and check their estimations. Some instruction may be needed in "working" the scale. Now, they arrange the items correctly and draw them, on another strip of paper, in the appropriate order. Both strips of drawn items could be used for a display. Following discussion would focus on estimation and how close each pair was to actual order.

2. Each student is given 1 item - such as a small stone. The task is:

   Each student must go outside and collect:

   - 3 items that she thinks are lighter than the stone
   - 3 items that she thinks weigh about the same as the stone
   - 3 items that she thinks is heavier than the stone.

   As students return, they check their estimations on the balance scale and display the items on a piece of paper with the headings:

Lighter than the Stone	Same Weight as the Stone	Heavier than the Stone

3. A) The teacher instructs the class that a uniform measure of weight is a gram (g). Examples of things that weigh a gram are given so that students can conceptualize.

Using a gram weight on the balance scale, the students compare a variety of objects they have selected. They arrange their items as to lighter than 1 gram or heavier than 1 gram. If an item actually weighs 1 gram, the group may be summoned to observe.

B) Now, the teacher introduces the kilogram by explaining that the gram is really such a small measure of weight that in order to balance heavier items we would need a heavier weight.

Task: The teacher places a kg weight on the balance pan. The student pairs place items (listed on an Assignment Sheet) on the balance pan to complete the questions.

ASSIGNMENT SHEET

Name: _____

Instruction: Fill in the _____

_____ potatoes balance 1 kg.

_____ workbooks balance 1 kg.

_____ tea cups balance 1 kg.

etc.

4. A) Using kitchen scales, the students weigh ingredients needed for a simple metric recipe. The teacher could weigh the first ingredient, then merely supervise and aid the students.

B) To gain experience changing grams to kilograms, the students are asked to pretend, visualize, that they need to change this recipe to feed a large crowd. They then could write out the recipe with the changed weights.

5. Students assemble product boxes. Each pair is asked to choose 3 boxes. Then, they circle the weight written on the box - they may use felt pens and create a design of some sort.

Student pairs are formed. One student from the pair weighs sand or beans to match the weight on each box. The other student then weighs the sand and identifies which box the weight came from.

When everyone has completed this task, the students cut the fronts off the boxes and create a collage.

6. Using the kitchen scales, each student is asked to:
   - list 10 things that they could weigh
   - have the list checked by the teacher
   - weigh and record the weight of these objects
   - again show the list to the teacher

Let's Check:

LET'S CHECK

Name: _____

A) Instructions: weigh the following and ✓ the right place.

	heavier	lighter	
a) 10 potatoes			than 1 kg
b) plant			than 50 g
c) rock			than 80 g
d) hammer			than 160 g
e) keys			than 70 g

B) Give the exact weight of these items

book _____ box of chalk _____

7 pens _____ pencil case _____

C) Give the total weight of all the items in B.

MEASUREMENT

Lesson 2: Liquid Measure

Materials: general, an assortment of containers - egg cups - yogurt container - coffee mugs - soup spoons - water glasses - baby food jars - "litre" containers - "millilitre" containers, measuring jugs - ml and l, funnels, product containers - ml and l

Teacher Preparation:

Probe.	Stencil
Activity 2.	Stencil
Activity 4.	Stencil
Activity 6.	Stencil
Let's Check.	Stencil

Vocabulary: millilitre, litre, abbreviations ml and l, capacity

Objectives: The student will demonstrate an understanding of the concept of liquid measure (ml and l) by:

- using nonuniform units of measure to determine the capacity of given containers
- selecting containers which have the estimated capacity of 1 L
- using a 1 L measure for comparing greater, equal, or lesser capacity
- determining the most appropriate unit of liquid measurement (ml or L)
- matching ml to L of equal value
- identifying the liquid measure on product labels
- measuring stated amounts of liquid

Probe:

PROBE

Name: _____

A) Complete the following

8 L = _____ mL _____ L = 5,000 mL

3 L = _____ mL _____ L = 9,000 mL

6 L = _____ mL _____ L = 1,000 mL

B) Add

a) 677 mL
392 mL
100 mL
= _____ L _____ mL

b) 905 mL
560 mL
300 mL = _____ L _____ mL

Subtract

a) 3L - 650 mL =

b) 2L - 900 mL =

C) How much water does it take to fill the 3 jugs. Use the measuring cup.

Jug 1 = _____ mL

Jug 2 = _____ mL

Jug 3 = _____ mL

Activities:

1. Students use dixie cups as a unit of measure. In pairs they are asked to:
   - find a short pitcher that holds more dixie cupfuls of water than a tall one
   - find a tall thin jar that will hold more than a short fat jar (measure with dixie cupfuls of water)

Before beginning this activity, students may estimate which of the provided pitchers and jars are likely to hold "more".

2. Student pairs will, using water and various provided containers, fill in the Assignment Sheet.

ASSIGNMENT SHEET

Name: _____

It took:

A) _____ coffee mugs to fill the cooking pot

B) _____ soup spoons to fill the cooking pot

C) _____ water glasses to fill the cooking pot

D) _____ baby food jars to fill the cooking pot

E) _____ egg cups to fill the cooking pot

F) _____ yogurt containers to fill the cooking pot

The students compare how many of each it took to fill the same cooking pot. Discussion focuses on the fact that in each case, the results were different because of the different capacity of each container. Capacity is defined as the maximum amount that a container is capable of holding. The teacher points out the need for a standard measure of liquid, and introduces the millilitre (mL) with examples of milk or water.

Because of the tiny amount equaling a mL the teacher shows a litre container and tells the students that 1,000 mL equals 1 litre (L). In a group discussion, the teacher and students think of liquids which are measured in this way (milk, gasoline...)

3. Each student makes a sign that says:

and cuts them out.

As the teacher reads out several sentences, the students must hold up the sign which best completes each sentence. For example:

a) To fill a car with gasoline, we need 60 _____ (students hold up appropriate sign)

b) The doctor migh take a blood sample of 10 _____.

c) A perfume bottle might hold about 20 _____.

d) A milk glass might hold 150 _____.

e) To give everybody in our group a drink of juice we would need about 2 _____.

4. From a wide range of containers provided in the classroom, student pairs are asked to choose 10 which they estimate will hold about 1 litre. They are asked to check their estimate of the first pick with a 1 litre measure and water. Then they continue picking the other nine. When all containers are picked, they check their estimations and record their findings on an Assignment Sheet.

ASSIGNMENT SHEET

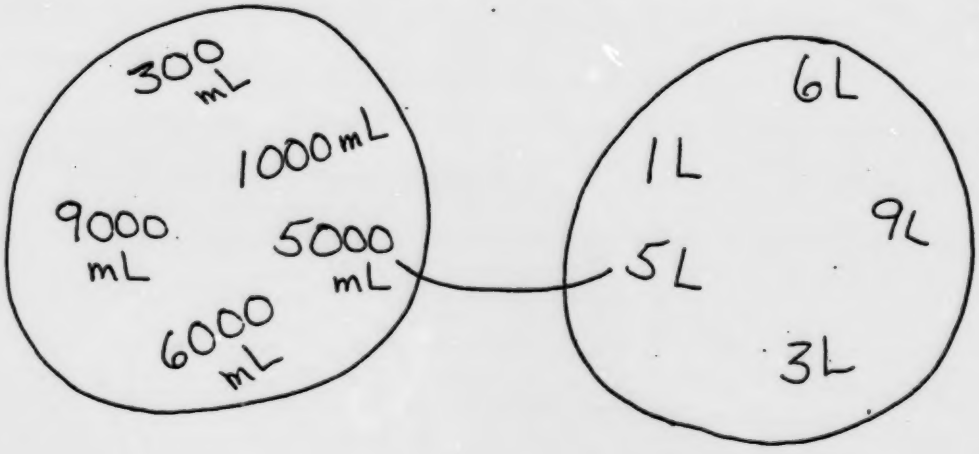
Name: _____

Draw Container	Measure more than 1 L	Measure about 1 L	Measure less than 1 L

5. Students help to assemble several liquid product containers (all containers should have the liquid measurement written on the label). With a felt pen, they circle the measurement. Then the students fill a measuring jug to the appropriate mar . For example, for a 300 mL juice tin the students would fill the easuring jug to the 300 mL mark with water. Now, as a measurement check, the students pour the water into the product container. It should be full.

6. The students match the following on an Assignment Sheet.

Match the following. 1 is done for you.



mL means _____

L means _____

Let's Check:

LET'S CHECK

Name: _____

A) Fill in _____

Litres	Millilitres
_____	3,000
2	_____
_____	1,000
15	_____
_____	9,000

B) Add

a) 250 mL
690 mL
+ 325 mL
= _____ L _____ mL

b) 900 mL
430 mL
+ 629 mL
= _____ L _____ mL

c) 760 mL
539 mL
+ 126 mL
= _____ L _____ mL

d) 3L - 290 mL = _____

e) 7L - 1326 mL = _____

C) Fill the measuring jug with:

a) 350 mL of water

b) 1 L of water

c) 600 mL of water

MEASUREMENT

Lesson 3: Linear Measurement

Materials: general, metre sticks/centimetre rulers for each student

Teacher Preparation:

Probe.	Stencil
Activity 3.	Stencil
Activity 5.	Stencil
Let's Check.	Stencil

Vocabulary: metric measurement, centimetres, metres, cm, m, directions, item, width, length, height

Objectives: The student will demonstrate an understanding of the concept of linear measurement, using centimetres and metres by:

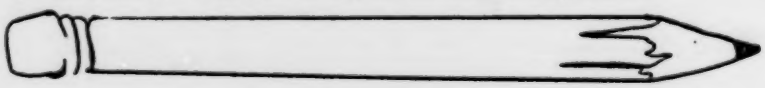
- ranging body outlines from longest to shortest and comparing the length of arms, legs, and hair
- using nonstandard units to measure specified objects and using this information to make a group chart
- using standard units to measure specified objects and lengths
- by converting and computing centimetres and metres

Probe:

PROBE

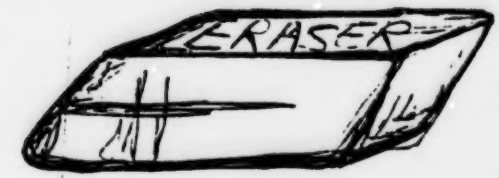
Name: _____

A) Use a centimetre ruler to measure these objects.

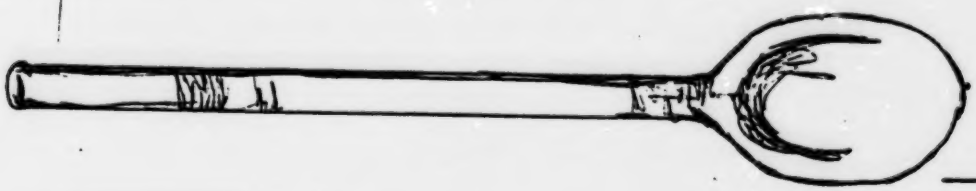


_____cm

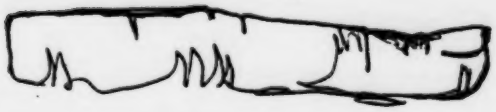
_____cm



_____ cm



_____ cm



_____ cm

B) Fill in each _____

134 cm = _____ metres and _____ cm

319 cm = _____ metres and _____ cm

6 m = _____ cm

4 m = _____ cm

Activities:

1. In pairs, students take turns lying on the floor and drawing around each other. They then fill in personal details and colour as desired. Students then cut out the outline drawings and arrange them on the wall from shortest to longest. Discussion centres on comparison of figures - which figure is longest, who has the longest hair, who has the shortest arms .... etc.

2. Again in pairs, students find their arm spans. A piece of string is cut to this length. Students practice using this length of string inside the classroom to measure desks, chairs, etc. Students are then asked to go outside and measure 10 specified items (for example: bicycle rack, planter, length of tennis net, space between goal posts, length of monkey bars, etc.) On returning to the class, the students make a chart to display this information. Drawings of the measured items may be incorporated into this chart.

3. A) Students are each asked to measure a collection of 10 things, using a fully extended hand span. They record this information on an Assignment Sheet.

ASSIGNMENT SHEET

Name: _____

Directions:

Measure how long each item is.

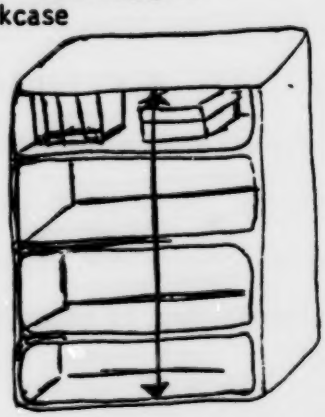
a. Desk

_____ hands long

b. Math text book

_____ hands long

c. Bookcase



_____ hands long

etc.

B) When the length of these items has been individually measured and recorded, the group meets to compare findings.

In discussion of each student's different measurements, it will become apparent that this system of measuring is only useful for rough estimations, and we need a more uniform system.

The teacher then instructs the group that a uniform system of measurement is the metric system. She introduces the idea of centimetres and metres. Each student is given a metre stick and instructed that within this metre there are 100 smaller markings, called centimetres because centi means 100. The students may practice with these.

C) The group then determines to find the exact and uniform measurement of the 10 things previously measured in Activity 3 A). Once each student has recorded their measurements in metres and centimetres, the group again compares measurements. This time the answers will be uniform.

4. Students, in pairs, are asked to first estimate, and then measure, to the nearest metre, objects around the school. They record this information on their scratch pads. The list of things to measure may include: width across hallway, length of a man, height of a door .....

5. Several masking tape lines are arranged on the floor. These range in length (dealing in less than a metre - centimetres, and greater than a metre - metres plus centimetres). These are arranged in a random order, but each line is numbered (so students can distinguish lines.) The students measure these lines and on scratch pads record the information. Students compare measurements and if necessary, remeasure until results are uniform.

6. After a quick review of

100 cm = 1 m

several conversions are done on the chalkboard. For example:

300 cm = 3 m

500 cm = 5 m

6 m = 600 cm

8 m = 800 cm

216 cm = 2 m 16 cm

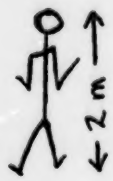
413 cm = 4 m 13 cm

An assignment sheet is given to each student. All students are encouraged to aid each other. The teacher is free to circulate and act as a resource person.

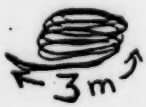
ASSIGNMENT SHEET

Name: _____

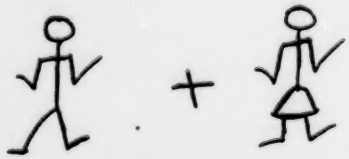
Directions: Fill in ____

A) 

2m = ___ cm

B) 

3m = ___ cm

C) 

1m 70cm 1m 35cm =

1m 70cm
+ 1m 35cm

Let's Check:

LET'S CHECK

Name: _____

A) Directions:

Use your ruler to draw lines that are:

a) 6 cm

b) 8 cm

c) 2 cm

d) 15 cm

B) Directions:

the right answer

To measure a:		CM	M
football field	you would use		
shoe	you would use		
parking lot	you would use		
(an)eraser	you would use		
paper clip	you would use		

C) Directions:

Add

3 m 60 cm	5 m 35 cm
+ 4 m 60 cm	+ 1 m 80 cm

MEASUREMENT

Lesson 4: Perimeter

Materials: General

Teacher Preparation:

Probe.	Stencil
Activity 5.	Stencil
Activity 6.	Stencil
Let's Check.	Stencil

Vocabulary: Perimeter, figure

Objectives: The student will demonstrate an understanding of the concept of perimeter by:

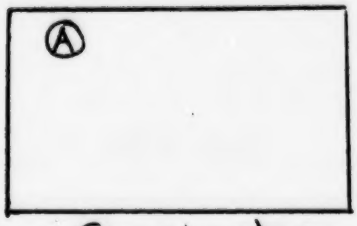
- measuring around body parts and recording the information
- creating a variety of shapes, using the same specified perimeter
- determining the perimeter of specified objects
- constructing shapes according to specifications and determining the perimeter
- determining the perimeter of given shapes when the linear measurements are given

Probe: The students complete an Assignment Sheet.

PROBE

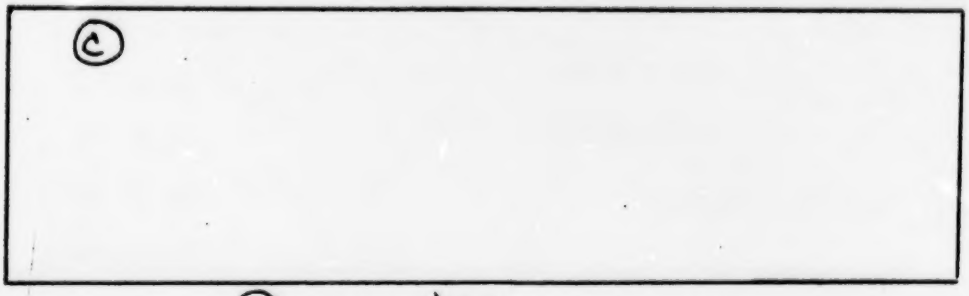
Name: _____

Instructions: Find the perimeter of each figure.



A perimeter = _____ cm

B perimeter = _____ cm



C perimeter = _____ cm

Activities:

1. The teacher instructs the group that the distance around a figure is called a perimeter.

   As a group students use pieces of string and a ruler to find the perimeter of a desk, a student's head, wrist, neck, etc. The findings are recorded on the chalkboard.

2. The students are asked to measure and cut a length of string (for example, 65 cm). With this, they are asked to make a shape. Students observe each others' shapes. The teacher draws attention to the fact that although there are several shapes, they all have a perimeter of 65 cm.

   The students are asked to rearrange their strings to form five different shapes, each will have a perimeter of 65 cm.

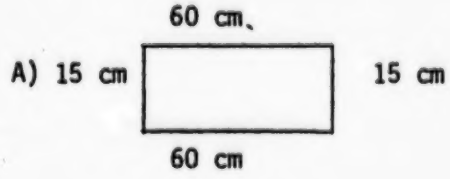
3. The students are instructed, using examples of their string shapes (with straight sides) that the sum of the measurement of each side equals the perimeter. The teacher draws a representation of a shape, with straight sides, previously constructed by a student. The teacher explains the measurement procedure involved.

Forming pairs, the students again create 3-sided shapes. These shapes are measured in order to find the perimeter. One student may measure the sides while the other finds the total, or perimeter.

4. Students are asked to find the perimeter of several objects in the room:
   - the front cover of a book
   - the window
   - a chair seat

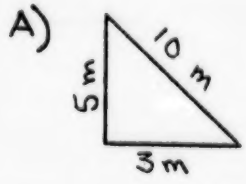
   They record these measurements on their scratch pads. A short discussion follows - the students share the information.

5. The students are given an Assignment Sheet with directions to, for example, make a rectangle with the measurements of 60 cm, 15 cm, 60 cm, 15 cm and find the perimeter..... make a triangle with sides 20 cm, 20 cm, 20 cm, and find the perimeter. Approximately 5 such specifications are given. They must then make these shapes on the floor with masking tape. The perimeter for each figure is recorded on the Assignment Sheet.
   For example:



perimeter = _____ m _____ cm

6. On an Assignment Sheet, students are asked to find the perimeter of 6 figures. For example:



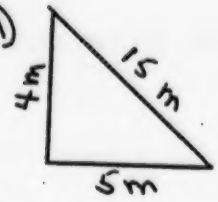
perimeter = ____ m

ASSIGNMENT SHEET

Name: _____

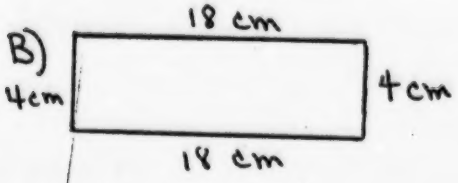
Directions: Find the perimeter of each figure.

A)



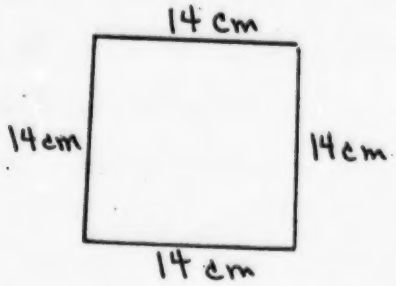
perimeter = ____ m

B)



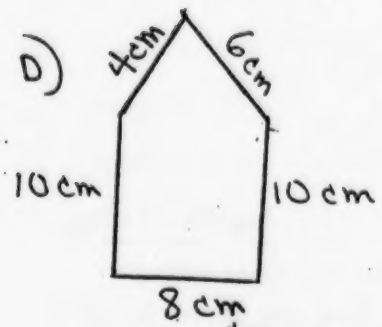
perimeter = ____ cm

C)



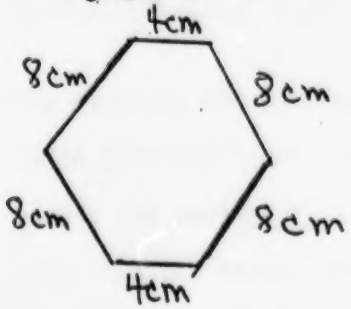
perimeter = ____ cm

D)



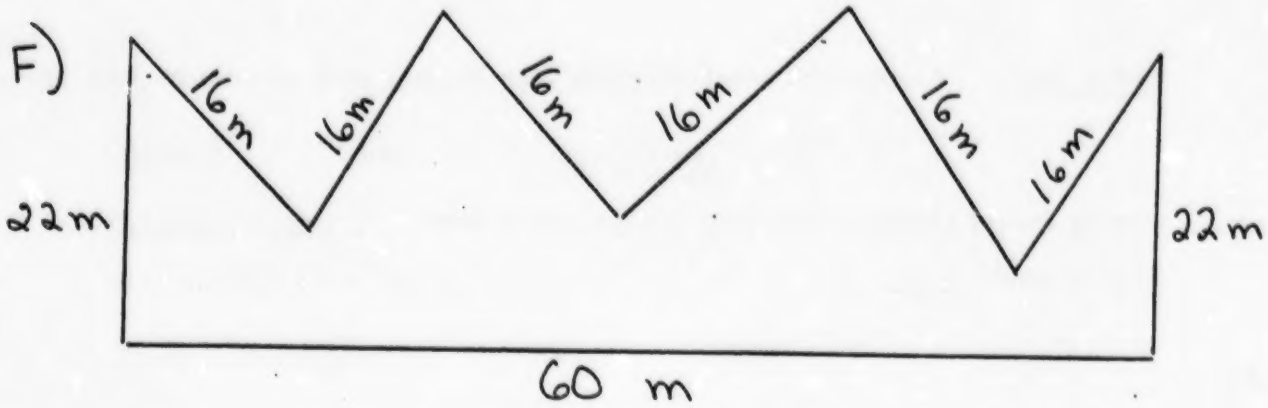
perimeter = ____ cm

E)



perimeter = ____ cm

F)



perimeter = ____ m ____ cm

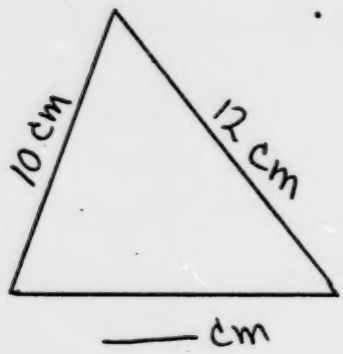
Let's Check: A stenciled sheet is given each student with directions such as:

LET'S CHECK

Name: _____

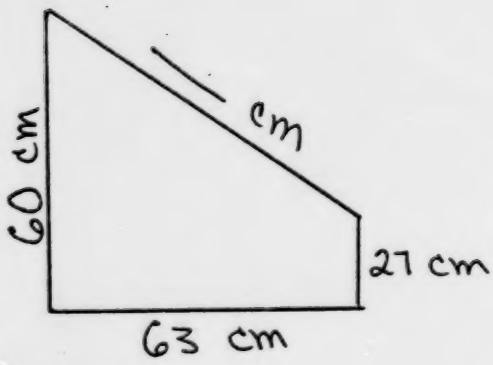
Fill in each _____

A)



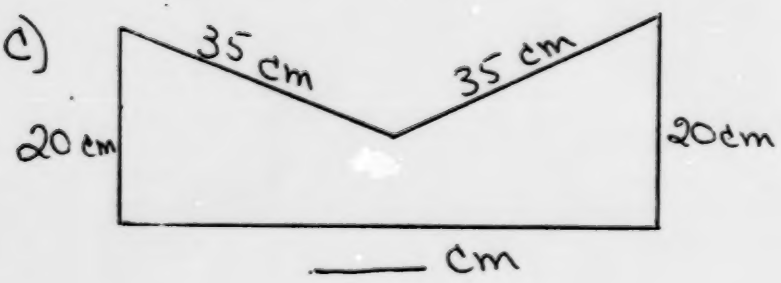
perimeter = 35 cm

B)



perimeter = 2 m 20cm

C)



perimeter= 1m 80cm

MEASUREMENT

Lesson 5: Area

Materials: general, graph paper, paint, newspaper, tracing paper, paper with a stick back

Teacher Preparation:

Probe.	Stencil
Activity 3.	Stencil
	Tracing paper with cm square grid drawn on it
Activity 4.	Cutting centimetre squares
Activity 5.	Graph paper with drawn shapes
	Chart
Activity 6.	Stencil
Let's Check.	Stencil

Vocabulary: area, region, cm^2, directions

Objectives: The student will demonstrate an understanding of the concept of area by:

- using and comparing non standard units to determine the area of a given region
- measuring given rectangular shapes, recording this information, and using the standard formulas $l \times w$ = area
- using a grid to determine the area of given shapes
- arranging standard units to arrange different shapes with equal area
- using the notation cm^2 appropriately

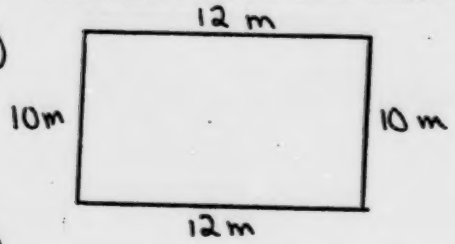
Probe:

PROBE

Name: _____

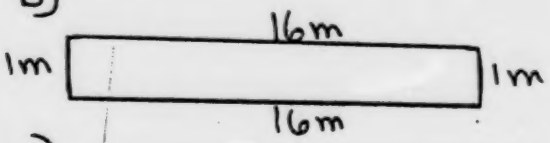
Find the area of each shape.

A)



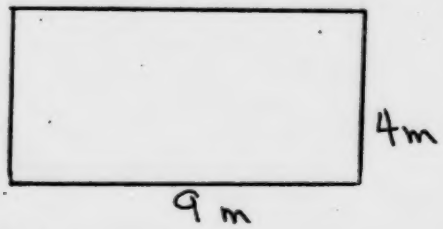
area = _____

B)



area = _____

C)



area = _____

Activities:

1. Each student is given a large sheet of newspaper (each the same size). They are each allowed to mix 2 tempura paint colours of their choice. Students then dip their hands in the paint. Beginning in the top left hand corner, they repeat hand prints until all the paper is covered.

   They then count how many hand prings it took to cover their paper and record this at the bottom of the newspaper.

   Students compare how many hand prints it took to fill their region (piece of newspaper). They discuss the fact that although the size of the paper was identical in each case, they got varying numbers of hand prints.

The teacher defines area for the students as, "the number of units, usually a square, it takes to cover a region". The group discusses this definition.

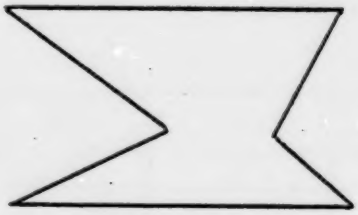
2. Student pairs design and cut out 1 large triangle, 1 large rectangle, and 1 large square from a brightly coloured magazine page or construction paper. These are then referred to as "units of area". Each pair, using their units of area, find out how many of each shape it takes to cover a specific region (for example, a previously marked masking tape region on the floor). The class then decides which unit of area was the most practical. The definition for area may be referred to. The square may then be used to cover various regions in the class (bulletin board, desk top ...)

   The information gathered in this activity may be used to make a class chart.

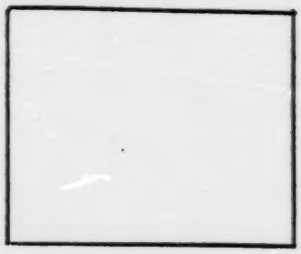
3. The students are given a stenciled sheet of various regions. For example:

ASSIGNMENT SHEET

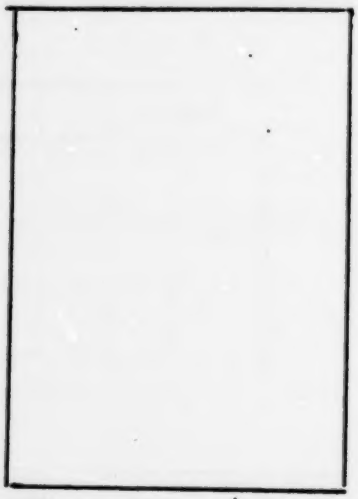
Name: _____



The area is ___ units



The area is ___ units



The area is ___ units

Each student colours the regions. The students are given a grid of tracing paper ruled with cm squares. They then measure each shaded region, and counting the number of shaded squares, fill in the _____.

The teacher must inform the students of the procedure involved with counting partially shaded squares.

4. Each student is given the same number of cm squares (for example, 30) cut from gummed or sticky-backed paper. They check the measurement of a square by using a cm ruler. All students agree that each square is 1cm in length and width.

   They may then arrange their squares in any connecting design. Students then display their gummed designs, with a title such as, "Area = 30 square centimetres".

   They may, if they wish, use another 30 squares to arrange a different design.

5. Each student is given a sheet of centimetre graph paper on which is drawn several squares and rectangles. Each shape is marked with a letter.

   A chart is at the front of the classroom. Students, in turn, record the number of squares for each region. The last 2 columns (l x w, area) may be completed by the whole group.

Region	length	width	l x w	Area
A	6	4	6 x 4	24 cm^2

Of course an explanation is required regarded l x w = area of a square or a rectangle.

The teacher refers again to the class chart. The area does equal 16, but 16 what? The area equals 16 square centimetres. At this point, the teacher uses the term square centimetre and adds cm^2 to the final column of the chart.

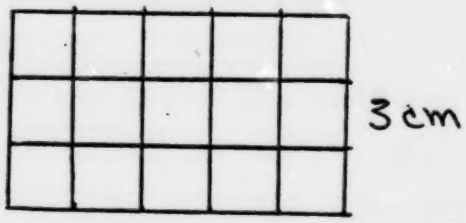
6. The students are given an Assignment Sheet. For example:

ASSIGNMENT SHEET

Name: _____

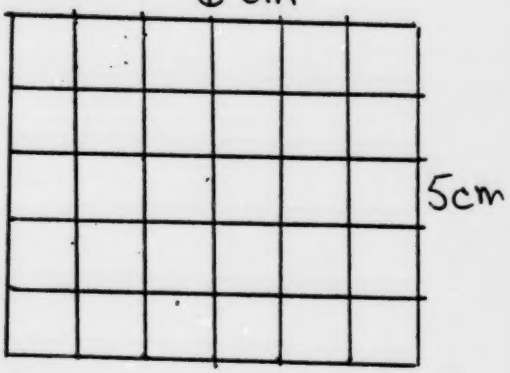
Directions: Find the area of each figure. Remember, length x width equals area (l x w = area).

A/



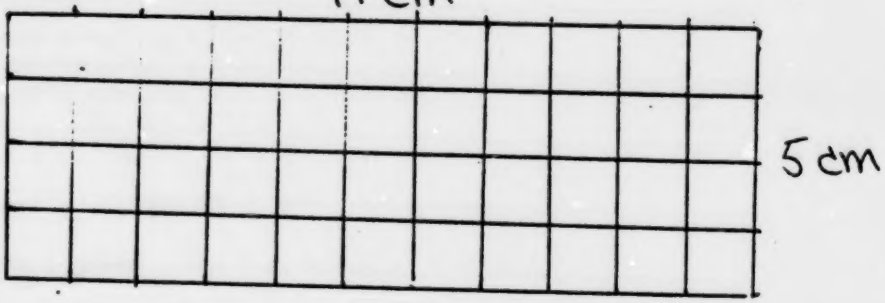
area = ___ x ___ = ___ cm^2

B/



area = _____ cm^2

C/



area = _____ cm^2

Let's Check: The students complete the following table. This is stenciled.

LET'S CHECK

Name: _____

	Length	Width	Area
a.	4 cm	6 cm	_____ cm^2
b.	3 cm	5 cm	_____ cm^2
c.	2 cm	8 cm	_____ cm^2
d.	14 cm	10 cm	_____ cm^2
e.	11 cm	7 cm	_____ cm^2

FRACTIONS

Materials: general, white paper plates, 5 apples, base 10 blocks, thread/needle

Teacher Preparation:

Probe.	Stencil
Activity 1.	Large Shapes cut in 1/2
Activity 3.	Stencil
Activity 4.	Fraction cards, circle pattern
Activity 6.	Stencil
Activity 8.	Stencil
Let's Check.	Stencil

Vocabulary: equivalent, denominator, numerator, whole, half, quarter, fraction, value, diagram, solution

Objectives: The student will demonstrate an understanding of the concept of a fraction as part of a whole by:

- shading sections of a diagram
- using appropriate vocabulary

The student will demonstrate an understanding of the concept of equivalent fractions by:

- trading sections of equivalent values
- shading sections of equivalent values
- creating a mobile of equivalent fractions

The student will demonstrate an understanding of the concept of fractions as part of a group by:

- physically representing parts of a group
- shading a given number of objects in a group

The student will demonstrate an ability to find a fraction of a given number by:

- using manipulative tools
- indicating the appropriate fraction on Assignment Sheet

Probe: The students complete a stenciled sheet. It is in 2 parts:

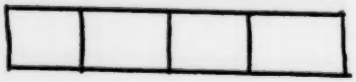
A) Students must shade 5 diagrams appropriately when given a fraction.

An example may be given. For example:

- shade each strip to show the fraction.

1 is done for you.

3/5 =

1/2 = 

4/7 =

B) Students must write the appropriate fraction when given an already shaded diagram.

Activities:

1. The teacher tells the students that when anything is cut in 1/2, each 1/2 is the same as the other.

   The students are told that they will be given only 1/2 of a shape and they must find the other that is hidden somewhere about the room. These shapes may be stars, triangles, abstract shapes.....

   When there are enough students to make this activity viable, each may be given 1/2 a shape. The students must find their partner with the 1/2 shape matching theirs.

   Discussion centres on the fact that each of the 2 pieces is a 1/2, and that together they form a whole (1).

   On a large sheet of display paper entitled "1/2 ... halves", the students glue their 1/2 pieces in a random fashion. Then, in turn, they connect the 2 matching 1/2 pieces with a felt pen. This becomes a wall display.

2. The group is presented with a problem. There are 10 students but we only have 5 apples, we don't want to leave anyone out. "Close your eyes and imagine a solution." While eyes are closed, the teacher may review the problem using descriptive words to aid visualization (big, red, juicy...). After a few moments, the students open their eyes and the teacher illustrates the problem by producing the apples and cutting each in 1/2. Students may then eat the apples. This activity may be altered to suit the number of students in the group.

3. Using the apples and shapes as examples, the teacher tells the students that when something is cut into 2 equal pieces we can write this as 2/2. When we have just 1 of those pieces, or halves, we can write this as 1/2. The top number, or numerator, means the number of pieces being used, the line means "of", the bottom number, or denominator, means the number of parts in the whole.

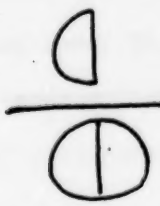
   The teacher illustrates with more examples on the chalkboard. The students participate by either shading parts of a diagram to comply with a written fraction, or by filling in the numbers to correctly describe a diagram.

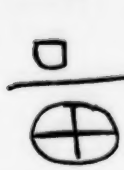
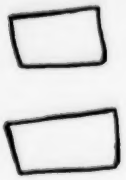
   When all students are familiar with this procedure they are given an Assignment Sheet. The group completes this together, with one helping the other. The teacher acts merely as a group member after she has lead the completion of the first question.

ASSIGNMENT SHEET

Fill in the □. The first one is done for you.

Name: _____

A)  $= \frac{1}{2} =$ 1 of 2 parts or one half

B)  $= \frac{\square}{\square} =$ □ of □ parts or 

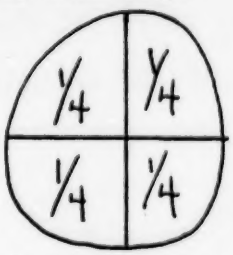
C) $= \frac{\square}{\square} =$ □ of □ parts or

D) etc.

Some words you may need: quarter, sixth, half, eight, etc.

4. Each student is given a piece of coloured construction paper and a pattern of a circle. The student draws around the circle pattern then cuts our her own circle.

Individually, students are told to divide their circles into 3 equal parts, 4 equal parts, etc. Each student is given a different number (denominator). Students then write the appropriate fraction in each section of the circle. The teacher should supervise this closely as several students may need help.



The teacher draws the group's attention to each student's assignment. Using the chalkboard, she writes:

- Jasmin divided her circle into 2. She made halves (2/2)
- _____ divided her circle into 3. She made thirds (3/3)

The teacher continues until all students are listed.

The students then piece together and pin their circle sections onto a display board. One student gives out cards (each card has a fraction written on it). Then, in turn, the students show their card and go to the board to collect the appropriate pieces of circle. As an additional exercise, they could write on scratch pads the fraction of sections still remaining on the display board.

The student who dealt must check that each student took the correct sections and correct number of sections. After this is done, the sections are replaced, fraction cards shuffled, and the process is repeated with a new student-dealer.

5. This activity requires 8 students. Students are given a white paper plate. Each student colours her plate a different colour. Then, the teacher tells each student to divide her plate into 1/2's, 1/3's 1/4's etc. and helps the students to make these divisions evenly. The students then label each section of their plate with the appropriate fraction. (The teacher does not assign $7\frac{ths}{\quad}$, but makes these herself).

The students sit in a circle with their paper plate sections arranged in front of them. They then trade back and forth. For example, "I'll give you 2/6 in exchange for 1/3." The object being to finish with as many different coloured sections as possible. When no more trading can be done, the game is complete. Each student saves their arrangement of sections for use in the Equivalent Mobile (Activity 7).

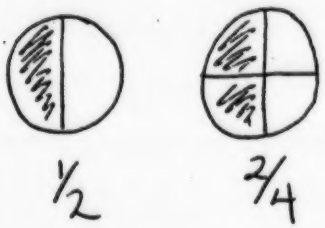
Using examples drawn from this game, the teacher explains "equivalency". "When 2 fractions have the same value, mean the same amount, they are equivalent."

6. The students complete the following Assignment Sheet.

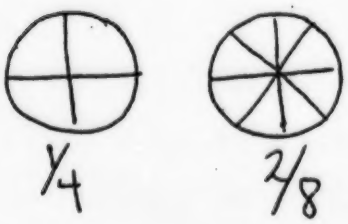
ASSIGNMENT SHEET

Name: _____

Directions: Shade in the sections to show the fraction. Then decide if they are equivalent. The first one is done for you.

A) 

They [(are) / are not] equivalent

B) 

They [are / are not] equivalent

etc.

7. Using a complete paper plate, the group constructs an equivalency mobile. Each student threads (using a needle and an equal length of coarse thread) the sections of paper plate they collected in Activity 5. These are arranged in any order. Each student then attaches her threaded sections to the outside of the paper plate. Each hanging group of sections equals 1 whole.

← paper plate

___ hanging sections.

This mobile is then hung from the ceiling.

8. A fraction may also mean part of a group. All students stand up. If there are 8 students then 8 is the denominator. Now, the teacher names students who are to sit down. "How many sat down?" If 3 sat down, then 3 becomes the numerator.

   - 3/8 of our class are sitting down.
   - "What fraction of the group are still standing?" (5/8)

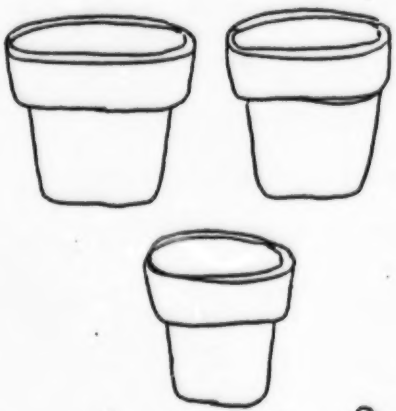
Several such activities may help to reinforce this concept. For example:
   - What fraction of the group are girls?
   - What fraction of the group are wearing jeans?

Each student then completes an Assignment Sheet such as:

Assignment Sheet

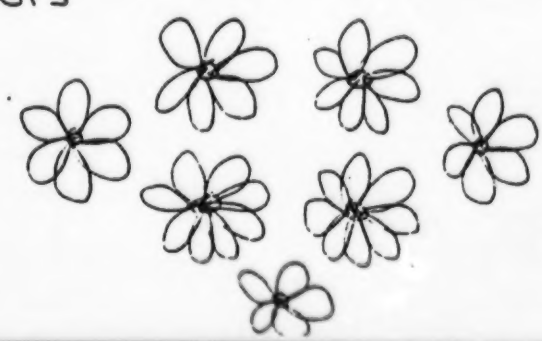
name: _____

I Directions: Colour each as directed
Write what fractional part the coloured part is of the whole group.



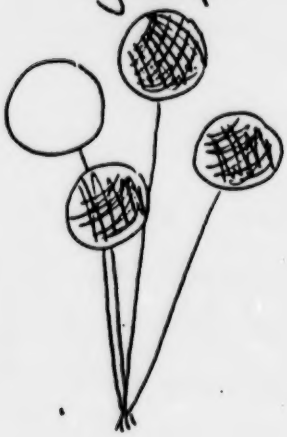
Colour 2 flower pots

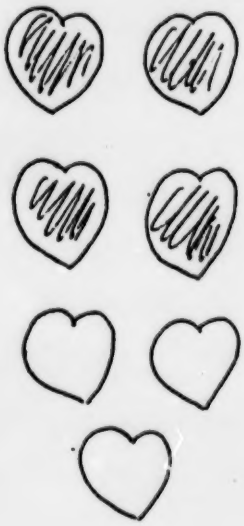
Colour 4 leaves

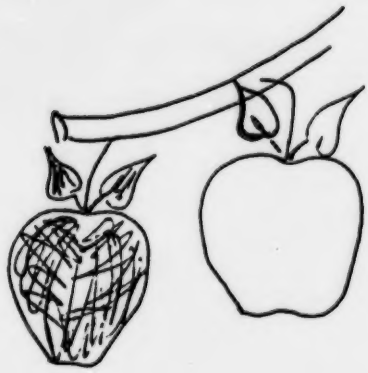


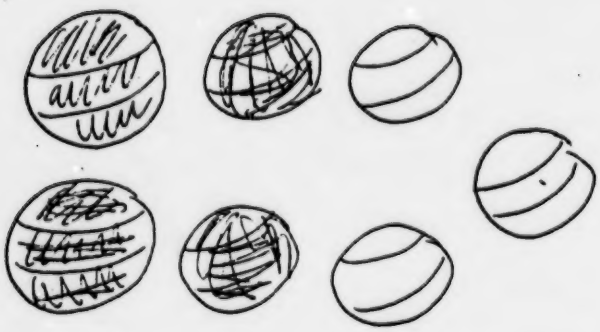
Colour 3 flowers

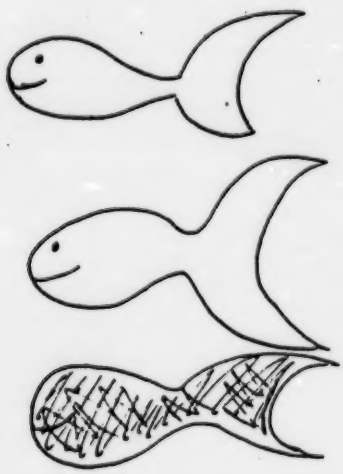
2. Directions: Write what fractional part the shaded part is of the whole group.



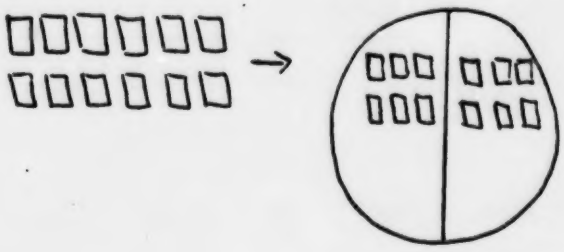








9. Students are given several cubes, blocks, objects and told to find 1/2, 1/3, 1/4, etc., of the total number. The teacher must ensure that such a division is possible. They experiment, possible using paper plates divided with a line and scratch pads to record the information. For example, the student dividing the blocks in 1/2:



1/2 of 12 = 6

After several attempts using different fractions and varying numbers of blocks, the students gather in a group. The group reviews the process they used to find fractions of a group.

The teacher introduces a new method. This is to divide the total number of objects by the denominator. For example, 1/2 of 8 would be 8 ÷ 2 = 4. Several examples are given.

The students are invited to participate with problems written on the chalkboard. Other or all students may check the answers using blocks and paper plates.

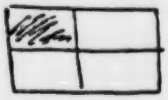
Let's Check:

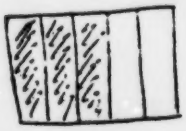
LET'S CHECK

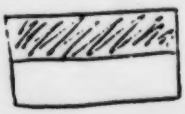
Name: _____

A) Write a fraction that describes each diagram. The first one is done for you.

a) = 2/3

c)  =

b)  =

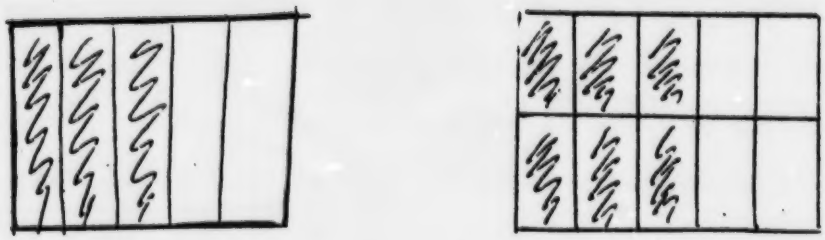
d)  =

etc.

B) Write the equivalent fractions. The first one is done for you.

a)

1/3 = 2/6

b) 

____ = ____

etc.

C) Fill in each _____. The first one is done for you.

a) 1/3 of 18 = 6

b) 1/2 of 12 = _____

c) 1/4 of 16 = _____

d) 1/5 of 25 = _____

e) 1/3 of 21 = _____

f) 1/6 of 36 = _____

GEOMETRY

Lesson 1: Basic Shapes and Symmetry

Materials: general, cardboard, small mirrors, spinner, half, shape, figure

Teacher Preparation: Probe. Stencil

Activity 2. Cardboard basic shapes

Vocabulary: circle, square, rectangle, triangle, symmetrical, line of symmetry, geometric, geometry

Objectives: The student will demonstrate the ability to identify the basic shapes (square, rectangle, triangle, circle) by:

- locating specified shapes
- drawing specified shapes
- identifying the basic shapes found in a picture

The student will demonstrate the ability to identify symmetrical shapes and lines of symmetry by:

- creating symmetrical figures
- identifying symmetrical letters of the alphabet
- using a mirror to complete a symmetrical figure

Probe: Each student is given a stenciled sheet.

PROBE

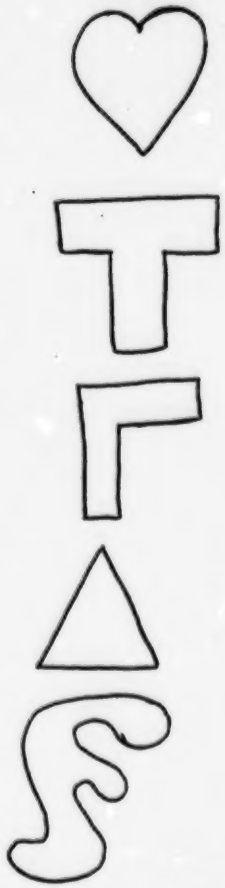
Name: _____

A) Put a ✓ in the right place

circle				
triangle				
rectangle				
square				

B) Are these figures symmetrical?

	Yes	No
a)		
b)		
c)		
d)		
e)		



If you ✓ yes, draw the line of symmetry.

Activities:

Basic Shapes

1. Students draw, colour, and cut out large basic shapes. As this is being done, the shape names are reviewed. A "spinner" is made (one from a previous lesson may be altered for use in this lesson - the basic shapes should be placed around the spinner). All the large coloured shapes are placed randomly on the floor. The teacher "spins" and all of the students jump to the designated shape. A student may take over the role of spinning.

Later, the shapes on the spinner should be replaced with the shape names - at this point, a student should be spinning and calling out the shape names. As the students become competent, more shapes may be included (this is true for all activities).

2. The group is given 2 sets of cardboard basic shapes (size is optional) and a mural sized piece of paper. They are told that the task is to create a mural using the basic shapes. Time is allowed the group to discuss the picture theme, individual student jobs, etc. Then, they proceed with the project.

   Upon completion, the students tally the number of each basic shape and include that information beside the mural. For example:

   This mural of _____ has:

   _____ squares
   _____ rectangles
   _____ triangles
   _____ circles

   Can you find them?

3. Symmetry

   A) Students are each given several pieces of paper and asked to fold these in the middle. They then draw half of a simple figure, keeping in mind that the folded line is the centre. Students then cut out these figures and open them up. They are told that one side of the figure is, as they can see, exactly like the other. Therefore, it is symmetrical. The fold is the line of symmetry.

B) Students are then given several more sheets of paper to draw symmetrical figures in the same way. Initially the teacher can make suggestions (butterfly, heart, kite) for this activity. This may lead to the creation of items for a wall display for the classroom or for a prominent place in the school.

4. Students make the letters of their first names in large block capitals. They then consider each letter to determine if it is symmetrical and where the line of symmetry is. They then cut out each symmetrical letter, mount it or make some sort of hanging. The title for this display could be "All These Letters Have Symmetry".

5. Students form pairs. Each student draws one half of a picture. She then passes it to her partner. Each student then uses a mirror to complete the picture (or figure if simplicity must be maintained).

Let's Check:

LET'S CHECK

Name: _____

A) Draw and label these shapes. Show their lines of symmetry.

a) circle

b) triangle

c) rectangle

d) square

B) Draw 3 symmetrical figures. Put in the lines of symmetry.

GEOMETRY

Lesson 2: Points, Lines, Rays, Line Segments

Materials: general

Teacher Preparation:

	Probe.	Stencil
	Activity 4.	Stencil
	Let's Check.	Stencil

Vocabulary: point, line, line segment, ray, figure, label, match

Objectives: The student will demonstrate an understanding of the concept of points, lines, line segments, and rays by:

- physically representing points, lines, line segments, rays
- drawing and labelling points, lines, line segments, rays

Probe:

PROBE

Name: _____

Draw each geometric figure.

Line

Point

Ray

Line Segment

Activities:

Line Segments

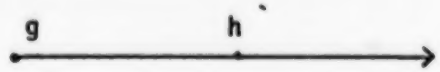
1. A) The teacher draws the group's attention to the chalkboard. The teacher then makes two points, labels them A and B, and connects them with a ruler. She states that this is a "segment" - just part of a line.

   B) Now the students represent a line segment. Two students are designated as points (using their initials rather than A,B). They are instructed to stand some distance apart. The rest of the group is then asked to fill in the space, sitting side-by-side between the 2 student points. Again, the teacher explains that they have created a line segment.

   C) The students return to their desks and make a number of segments on paper. They are reminded to label the points. This way, the segments have a name, in a group of segments one can be identified.

Rays

2. A) On the chalkboard, the teacher makes two points and labels them. They are connected in the following manner:



   The group is told that this is a "ray". It has a starting point but the arrow shows that it keeps going on forever.

   B) Next, two students are designated as points (again using their initials). A third student starts at one point, extends her arm (to indicate the arrow) and runs or walks to the other student - point and beyond. All students should have a turn participating. This may be done outside.

   C) The students return to their desks and make rays on paper. They are reminded to label each one.

Lines

3. A) On the chalkboard, the teacher draws a point. From this point, she draws 2 rays - one going in each direction.

The teacher states that this is a line - the arrows show that it keeps going on forever, it doesn't really have a beginning or end.

B) One student is designated as a point. Two other students cluster around the student-point (one directly opposite the other) and each extends her arm to indicate the arrows. Both sutdents then run or walk in the direction they are pointing. All students should have a turn participating in line creation. Again, this activity is best done outside.

C) The students return to their desks and practice drawing and labelling lines.

4. The students complete an Assignment Sheet.

ASSIGNMENT SHEET

Name: _____

Label each geometric figure. Use these names:

point, line segment, line, ray

a) A B

Figure a) is called a _____.

b)

Figure b) is called a _____.

c) E.

Figure c) is called a _____.

d)

Figure d) is called a _____.

These may be repeated several times.

5. Using, for example:

yellow felt pens for rays

blue felt pens for lines

red felt pens for line segments

individual students, pairs, or small groups, create designs or pictures. These are mounted and made into a wall display. A "KEY" should be included in the display. For example:

KEY

Yellow	for rays
Blue	for lines
Red	for rays

Let's Check:

LET'S CHECK

Name: _____

A) Match the name to the geometric figure.

Ray

Line

Segment

Point

etc.

Each name may match with more than 1 geometric figure.

B) Draw and label Line AB

Draw and label Line Segment CD

Draw and label Ray EF

GEOMETRY

Lesson 3: Angles, Perpendicular/Parallel Lines

Materials: general, large chalk - compass (used for drawing chalkboard figures), tracing paper

Teacher Preparation:

Probe.	Stencil
Activity 7.	Stencil
Activity 8.	Stencil

Vocabulary: perpendicular, parallel, angle, vertex, sides, intersect, pair

Objectives: The student will demonstrate the ability to identify angles by:

- locating and drawing angles found in the environment
- drawing various angles and locating the vertex
- labelling angles using alphabetical letters
- following verbal directions to draw and label angles

The student will demonstrate the ability to identify perpendicular and parallel lines by:

- using masking tape to create parallel lines
- measuring to check that lines are parallel
- drawing parallel lines
- locating, drawing, and labelling examples of perpendicular and parallel lines in the environment
- checking, using tracing paper, that lines are perpendicular
- identifying perpendicular lines on an Assignment Sheet

Probe:

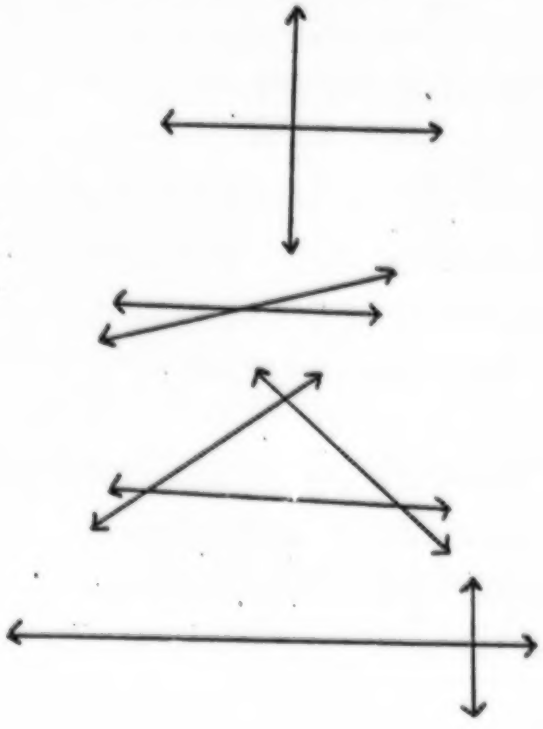
PROBE

Name: _____

A. Circle the angles

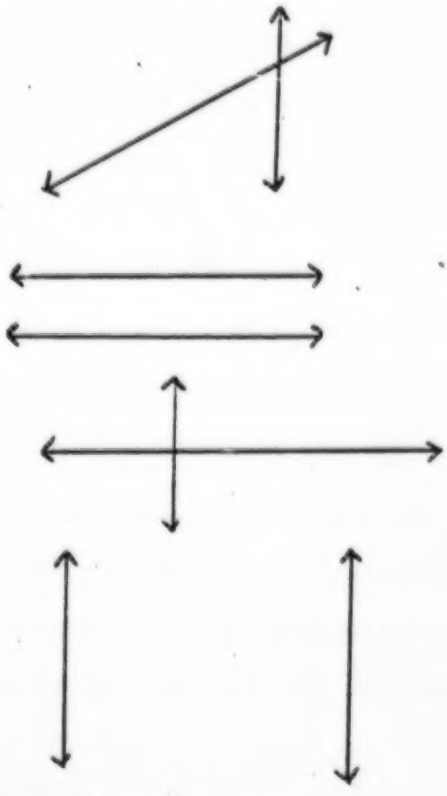
B. Are these perpendicular lines?

Yes No



C. Are these parallel lines?

Yes No

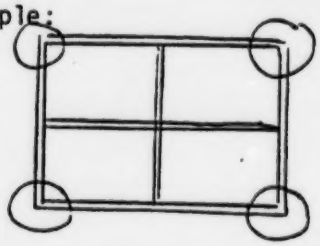


Activities:

Angles

1. A) The teacher draws the student's attention to furniture and fittings in the classroom to introduce angles. For example, the chalkboard, where the line segments meet, shows an angle - a corner. Several examples of angles are given. The students are encouraged to contribute. When all are competent, students walk around the room to find an angle, which they stand beside. The teacher checks their choice and shares with examples with all the students.

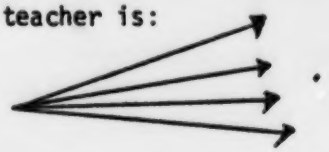
   B) Students then are allowed time to roughly draw various angles found in the room. The students may sit at their desks or, wander about the classroom looking for, as yet, undiscovered angles. After the student has drawn an angle (the item containing the angle), she may wish to label it. For example:



   C) The students now come together as a group in order to share their drawings. At this time, all students could look for drawn angles that may have previously been missed. For example, the above window has more angles than circled.

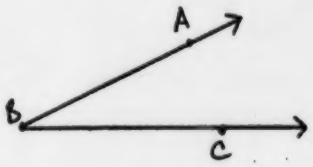
2. A) Using pencils, pens, rulers, (any general item with a straight edge) the students create their own angles. At this time, the teacher should emphasize that some angles are more open than others. The teacher may demonstrate this by using a large chalk-compass. Holding the compass facing the students, she could easily manipulate one "leg" to vary the angle. At different stages, she could ask, "Is this still an angle?"

The students should be encouraged to look at the formations others have made. A formation that students may not think of, but could be suggested by the teacher is:



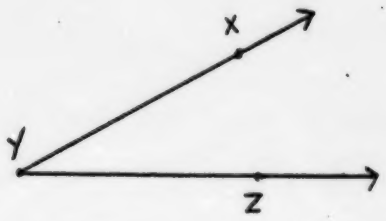
B) The teacher may instruct the students that the point, where the two sides meet is called the vertex. Now, the students may refer to the drawings they did in Activity 1. They put a coloured "X" on every vertex.

3. A) The teacher reviews, with the group, the way lines and line segments were names with letters. She now draws an angle on the chalkboard and tells the class that angles are named with letters also. She then appropriately labels the angle. For example.

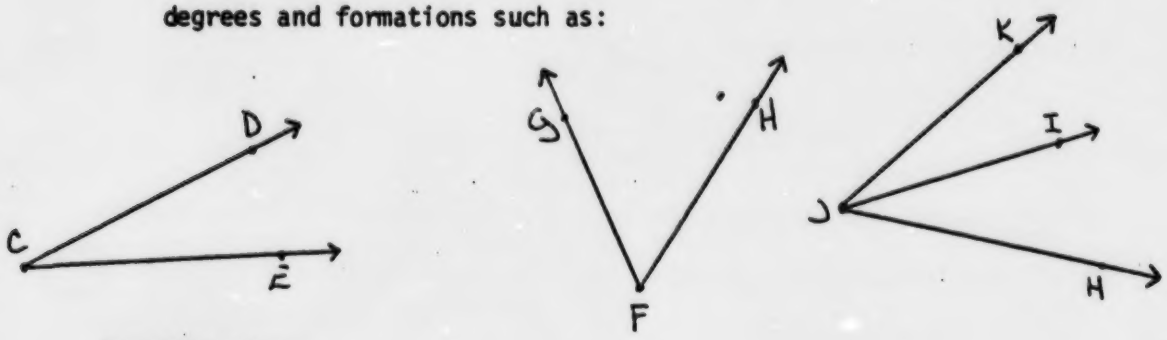


This angle is called, "angle ABC". The teacher then asks for a student to move to the chalkboard and mark the vertex, and another student to mark the sides.

B) The students are asked to draw three points, not in a straight line, and label them X, Y, Z. Now, they are asked to draw YZ, then YX. Next, the students are asked to mark the vertex. The teacher should circulate to ensure that all students remain "on track".



C) The opportunity is given for the students to create and label their own angles. They should be encouraged to draw angles of different degrees and formations such as:



Parallel Lines

4. A) The teacher introduces parallel lines by drawing 2 such lines on the chalkboard. She states that:

   - these lines actually go on and on (indicated by the arrows) ⟷
   - these lines will never cross each other, they will remain the same distance apart, they are called "parallel lines".

   B) Now, student pairs are formed. Each pair is given masking tape and told to go into the hall, or some other large area, and make parallel lines by:

   - one student laying down a masking tape line
   - the other student laying down a parallel line
   - both students "checking" by measuring the distance at each end and in the middle.

   The students may circulate to view each other's parallel lines. At this point, it could be emphasized that it doesn't matter how close together or far apart the lines are.... as long as they remain the same distance apart, they are parallel.

5. A) The students are asked to search the school for 10 examples of parallel lines. They are each given a sheet of paper which they fold into 10 spaces. In each space they should indicate where they found

the parallel lines, what the object was, and how many pairs of parallel lines constituted the object. They may record by drawing and writing in any appropriate combination. On their return to the classroom, students share their information and drawings.

Perpendicular Lines

6. The teacher introduces perpendicular lines by drawing a diagram on the chalkboard.

She emphasizes that, these two crossing lines form 4 angles, the angles are all the same size. Therefore, we say these lines are perpendicular.

Using a ruler, students draw perpendicular lines. At first, to check that angles are of equal size, they use tracing paper. Students tract each diagram onto their tracing paper. They then rotate the tracing paper over the diagram to see if the angles are, in fact, the same size.

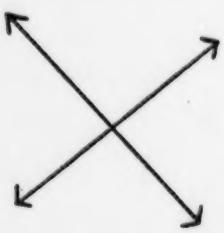
7. The students are given an Assignment Sheet with several crossing lines (as below). The instructions are read aloud to them.

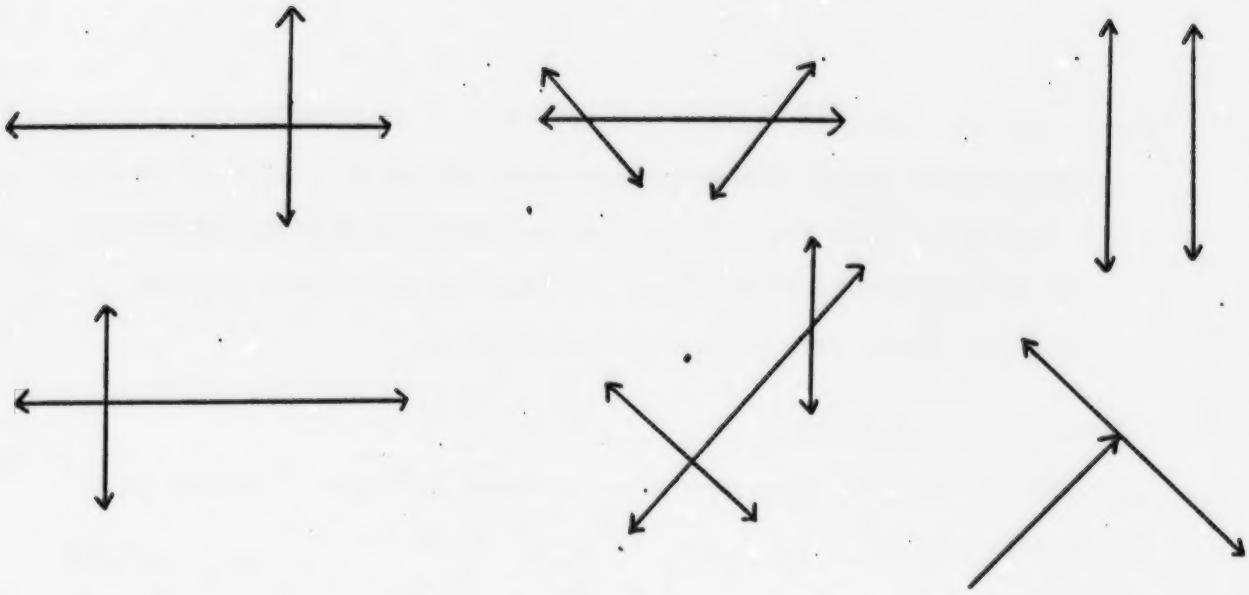
ASSIGNMENT SHEET

Name: _____

Instructions: Circle the perpendicular lines.

Use tracing paper to check that the angles are of equal size.





8. As preparation for Activity 8 the teacher tells the students they are going on a walk to find examples of angles, perpendicular and parallel lines in the environment. She gives examples of how they might interpret the environment, allows the students to visualize what examples they may encounter, and asks for examples to be shared with the entire group. Students may choose to work individually or in pairs. They are given an Assignment Sheet, as below. This should be viewed before embarking on the walk.

ASSIGNMENT SHEET

Name: _____

A. 5 examples of angles.

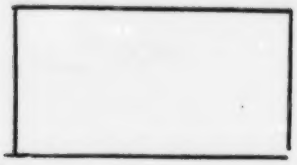
1. 2. 3.

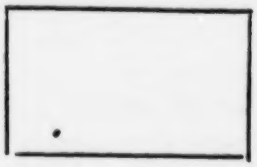
Where I Saw it _____ _____ _____

4. 5.

Where I Saw it _____ _____

B. 5 examples of perpendicular lines.

1. 

2. 

3.

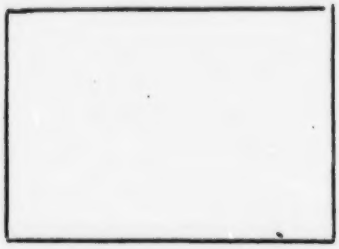
Where I Saw it _____ _____ _____

4.

5.

Where I Saw it _____ _____

C. 5 examples of parallel lines.

1. 

etc.

Where I Saw it _____

On return to the classroom, the students may create a wall display. The decision should be left to the students as to what type of display they will make. The teachers should feel free to act as a group member and offer suggestions.

Let's Check:

LET'S CHECK

Name: _____

A. Draw 4 examples of angles.

Label each angle with letters.

Circle each vertex.

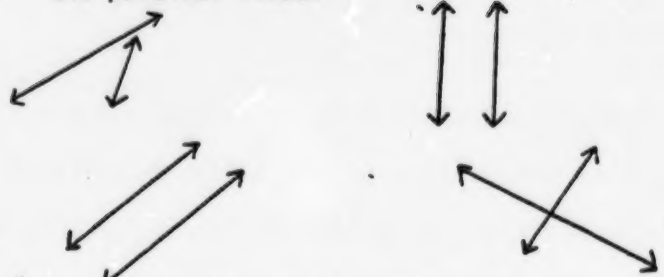
1.

2.

3.

4.

B. ✓ the parallel lines.



C. ✓ the perpendicular lines.